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ORIGINAL COMMUNICATIONS.

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EXPERIMENTAL STUDIES OF THE EFFECT OF VARIOUS ATMOSPHERIC CONDITIONS UPON THE UPPER RESPIRATORY TRACT.*

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At present the importance of fresh air in the preservation of health and in the treatment of disease is widely appreciated. If we stop to consider the fundamental principles underlying the action of fresh air upon the human organism, we are forced to admit that our knowledge is inadequate and to a certain extent unsatisfactory.

Factors in Ventilation. There is considerable confusion among engineers and hygienists as to what constitutes proper ventilation. This appears to be no fault of the mechanics involved, as the engineers confidently assert their ability to adequately meet any standards which may be adopted as representing good ventilation, and claim that all they need are reliable standards.

Progress has been made to this extent—we can confidently discard the chemical constituents of the air as of no great importance. It has been demonstrated that the amount of oxygen or the proportion of carbon dioxide may vary between wide limits without producing physiological effects. Moreover, the effects of poor ventilation can no longer be explained by the presence of volatile organic poisons in the air.

*Conducted under the auspices of the New York State Commission on Ventilation.

Read before the American Laryngological, Rhinological and Otological Society, at the Twenty-first Annual Meeting, in Chicago, June 15-16, 1915. Awarded, for meritorious research, the Gold Medal of the Society.

The tendency at the present time appears to be to explain the physiological effects of air on the human body in terms of the physical influence exerted, the principal factors being temperature, humidity and air movement.

Hermans[1] was the first to suggest that the bad effects of poor ventilation are due primarily to the inability of the body to cool itself because of the increased temperature and moisture of the surrounding air. Since that time, many other observers, notably Rubner,[2] Flügge,[3] Haldane[4] and more recently Leonard Hill,[5] have contributed largely to our knowledge of the action of various conditions of the atmosphere upon the human body, both in chamber experiments on man and also by numerous clinical observations.

While the general principles seem to be established, there is still considerable lack of uniformity in the ideas expressed as to what variations in the atmosphere are most harmful and which most beneficial.

When we turn to the treatment of disease, particularly respiratory diseases, we find the open air method generally adopted, but here, too, we note the lack of accurate knowledge of certain principles which appear to be fundamental. If the important factors in proper ventilation are temperature, humidity and air movement, they probably are no less so in the application of open air to the treatment of disease.

General Physiological Considerations. It may not be amiss to review certain fundamental considerations.

The internal temperature of a healthy man is fairly constant, varying not more than one or two degrees Fahrenheit in the tropics or in the Artic regions. This capacity for heat regulation depends largely upon the vaso-motor system and the sweat glands. The production of internal heat is a result of metabolism. Ability to maintain a constant body temperature depends to a considerable extent upon the possibility of adequate heat elimination. This elimination of heat takes place mostly through the skin, the heat being lost by radiation, conduction and evaporation. The amount of heat lost from the surface of the body by radiation and conduction depends largely upon the temperature of the surrounding air, the amount of heat lost by evaporation upon the humidity. Inasmuch as the humidity of the air immediately about the body is rapidly increased by the escaping moisture, the amount of air movement, by modifying this "aerial envelope," materially affects the heat lost by evaporation. Also, inasmuch as moist air is a better conductor of heat than dry air, the heat lost by conduction is materially

affected both by the humidity and by the air movement. Clothing and muscular activity are additional factors.

Effect of Cold. Before passing to our own experiments, let us review briefly the theories of those who hold that exposure to cold is a frequent direct or indirect cause in the production of many diseases, particularly disorders of the respiratory tract.

The physiological lower limit of atmospheric temperature appears to be less accurately established than the upper. Blood temperature of 68 degrees Fahrenheit is incompatible with life, but this has only been noted after long and severe exposure to low temperatures. Just where the physiological advantages of cold temperature pass over into the disadvantages of pathological change, has not been accurately determined.

Some experimental evidence exists to show that the influence of cold is important not only upon the respiratory tract, but also in rheumatism, neuritis, neuralgia, myalgia and paroxysmal haemoglobinuria.

Resistance to infection is also supposed to be influenced by cold. For example, Pasteur[6] found that although the common fowl is not susceptible to anthrax, it became susceptible after being made to stand over night with feet in cold water. Lode,[7] Fischel[8] and Durck[9] experimented with rabbits and guinea pigs. After being shaved, the animals were chilled in various ways, and the great majority of them are claimed to have either succumbed to autoinfection or to have proven far more susceptible to inoculation with pathogenic bacteria than control animals.

As an indirect cause of disease, numerous observers have shown that vaso-motor contraction of the skin vessels, due to cold, is accomplished by reflex dilatation of vessels in other parts of the body, the resulting congestion of certain tissues or organs being held accountable for many of the so-called "cold" diseases.

Rossbach[10] and Aschenbrandt, after opening the trachea of a cat, applied warm compresses to the belly of the animal followed by ice compresses half a minute later. This was followed by a gradual vascular dilatation shown by redness, and finally after five or ten minutes by a dark, purplish color, accompanied by markedly increased secretion of mucus.

Winter[11] claims that the changes in the tracheal mucosa are the same as those occurring in the development of inflammation and, therefore, represent true catarrhal inflammation. He thinks that a predisposition to catarrhal attacks of this nature follows severe illnesses of childhood when the affected vessels are relaxed without

subsequently regaining their tone. Likewise, severe muscular exertion in hot or vitiated air, he claims, leads to active dilatation of the vessels of the respiratory mucous membrane, and if there now follows a sudden exposure to cold, he thinks that a condition predisposing to catarrhal inflammation is produced.

Meuzer[12] thinks that the observations of Rossbach and Aschenbrandt are of little value because the trachea was opened and so exposed directly to the outside air. He believes that by warming and moistening the cold air, the nasal mucous membranes become dry and anaemic and the blood in the vessels more viscid, resulting in lessened phagocytosis and lessened resistance to bacterial invasion.

Kuhn[13] holds that long exposure to cold produces dryness of the mucous membranes and so predisposes to cold. He thinks, however, that a short exposure may protect from infection if it is followed by reaction characterized by hyperaemia of the skin and mucous membranes.

Leonard Hill,[5] using a nasal speculum and mirror, observed that the nasal mucosa became swollen and red in warm, moist air, accompanied by a marked increase in the amount of secretion. On passing from warm to cold air, he found that the mucous membranes became paler, but still remained swollen. He believes that this condition predisposes to disease for the reason that the defensive mechanism of the blood, the immunization properties of the plasma, the cleansing action of the cilia and the phagocytic action of the white blood-cells are all diminished by the cold, while the pathogenic bacteria find a suitable nidus for their growth in the secretion of the swollen mucous membrane. He found that keeping the air in motion in warm rooms very materially interfered with the hyperaemic effect, and believes that in this way the massivness of direct infection is reduced. He also observed that warm, dry air produced less swelling and secretion than warm, moist air.

Chodounsky,[14] in an excellent monograph, contends that respiratory diseases are entirely a matter of infection, and that exposure to cold and variation in atmospheric conditions have no effect.

Many observers hold that respiratory diseases are due to infection from dormant bacteria which remain latent in the respiratory tract, and that disease only occurs when conditions of atmospheric air are such as to render the mucous membranes more susceptible to bacteria.

Another interesting hypothesis to explain the relation of cold to disease is based upon chemical reactions.

Esch[15] believes that during the winter when living is largely indoors and unhygienic, the blood contains an excess of excretory

products, and during exposure to cold, large quantities of this vitiated blood are forced into the internal organs, tending to cause disease.

F. Mueller,[16] after severe exposure to cold, noticed vascular stasis in the exposed part, and found that following this the blood undergoes chemical changes as a result of which poisonous products are carried to the body as a whole. Nebelthau,[17] in experimenting with dogs after severe chilling, was able to demonstrate hemoglobinaemia, but not hemoglobinuria.

When we attempt to sum up the results of these various observations and opinions, we find it difficult to arrive at a satisfactory conclusion as to the exact place of atmospheric changes of temperature in the production of respiratory disease. For this reason we thought it worth while to attempt to add something to our knowledge of this subject by direct observations upon the respiratory tract under conditions which could be absolutely controlled as to temperature, humidity and air movement.

In this work we were ably assisted by Dr. Robert E. Buckley, who helped in making the examinations of the subjects.

The Commission placed at our disposal two adjoining rooms, approximately ten by fourteen feet each. These two rooms were so arranged that any desired degree of temperature and humidity could be secured and recorded.

Room A, the Control Room, is fitted with white tiled walls, and with machinery for controlling atmospheric conditions in both rooms, viz., fans, air-washer, heating stacks, steam lines and ducts.

Room B, the Observation Room, is also fitted with white tiled walls, covered with cork-board, cement and impervious paint. The two rooms are adjacent with a window in the common wall.

The temperature and humidity conditions in Room B were recorded continuously by a Bristol recording wet and dry bulb thermometer. In Room A the records were taken by means of a sling psychrometer.

The terms used in defining the conditions of temperature employed are as follows:

Normal	—68°	F.	temperature,	50	per	cent	relative	humidity
Cold	—50°	"	"	50	"	"	"	"
Hot dry	—80-86°	"	"	20-30	"	"	"	"
Hot moist	—80-86°	"	"	80	"	"	"	"
Hot medium	—80-86°	"	"	50	"	"	"	"

As it seemed desirable to substantiate the results of the clinical examinations of the nasal passages in the various experiments by a more exact method, we have made Glatzel mirror records in prac-

tically all experiments except those made in the hot, moist room (86° F., 80 per cent relative humidity).

It was necessary to make some changes in the old Glatzel metallic mirror, which was altered to suit our requirements.

Figure A shows the improved Glatzel metallic nasal mirror with the moisture deposit from a man with normal nasal passages.

A brief description of the method for employing the mirror follows:

The subject is instructed to keep his mouth tightly closed and to breathe quietly through the nose. The plate is taken from the water-bath, dried with a towel, and held below the nose just above

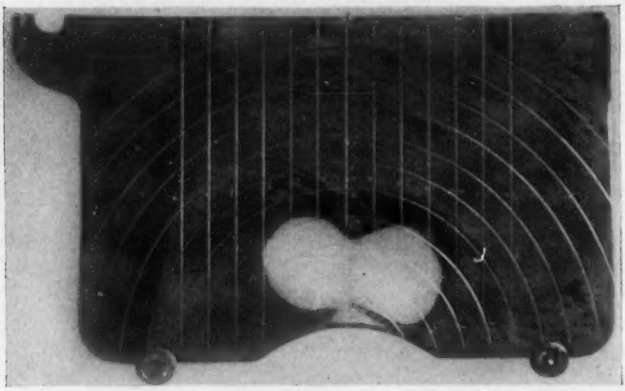

Figure A.—Author's modification of Glatzel mirror. Shows moisture deposit from a normal nose.

the muco-cutaneous border of the upper lip (See Figure B). After twenty seconds (timed by a watch), the examiner traces the outlines of the moisture deposit on the metal plate, using a pencil made of tailors' beeswax. It is important that the tracing be made exactly at the end of inspiration and after a fixed time—for example, twenty or thirty seconds. If the moisture deposit is measured immediately, its outlines are too large and rather indistinct. A little practice soon enables the examiner to obtain fairly accurate results.

When the plate is held under the patient's nose, the moisture deposit gives a picture of the cross-section of the nostrils through which the air is expired. The primary factors affecting this deposit are: the temperature and humidity of the expired air; changes in the air passages; the temperature of the room in which the record is taken; the exact time in the respiratory cycle in which the draw-

ing is made; the position in which the plate is held; and, lastly, variability in the temperature of the plate. The air capacity of the lungs also influences the amount of expired air, consequently the moisture deposit is smaller with children than with adults.

Uniformity is aimed at by having the subject hold the plate in a horizontal position, and by having the plate itself, when not in use, kept at a constant temperature. This is accomplished by placing the plate in a bath of weak lysol solution, maintained at 68 degrees F.

Records have been taken at various temperatures and humidities from 45 degrees F., 50 per cent relative humidity, up to 86 degrees F., 50 per cent relative humidity. Within these limits, the temperature of the air does not materially affect the accuracy of the results. The plate cannot be employed in very hot, moist conditions (86° F., 80 per cent relative humidity) owing to the precipitation of the moisture in the air upon the plate.

Figure B.—Shows proper method of holding Glatzel plate.

Examples of Glatzel plate records are shown below.

OUTLINE OF EXPERIMENTS.

1. *Series A.* Examination of 131 cases changing from one atmospheric condition to another.

2. *Series B. Studies in Air Movement.* Examination of 77 cases, changing from one atmospheric condition to another with fans blowing directly on the face.

3. *Series C. Skin Reflexes.* Examination of 57 cases with body in one room and head in another room having a different temperature.

4. *Series D. Skin Reflexes.* Examination of 42 cases with the body exposed to one temperature and the feet immersed in a water-bath of a markedly different temperature.

5. *Series E. Studies of Workers Exposed to Dry Heat.* Examination of 45 cases of workers in dry heat (firemen, stationary engineers, boilermakers, etc.), on going from one temperature to another.

6. *Series F. Studies of Outdoor Workers.* Examination of 58 cases of outdoor workers (truckmen, drivers, etc.), on going from one temperature to another.

7. *Series G. 1. Studies of Cases of Atrophic Rhinitis Corresponding to Workers in Moist Heat;* 39 observations on cases of atrophic rhinitis on going from a hot, dry room to a cold room, and vice versa.

It was found that a large proportion of workers in hot, moist rooms (steam laundries) suffer from atrophic rhinitis. Owing to the difficulty of securing employees of laundries who could be induced to give the time required for the experiments, we were forced to substitute other subjects for this group. Cases of atrophic rhinitis were therefore selected elsewhere, and used in place of actual laundry workers.

8. *Series G. 2. Examination of Forty-six Laundry Workers* while on duty in two steam laundries in New York City.

9. Experimental observations on the larynx and trachea of dogs subjected to peripheral stimulation by means of heat and cold.

The subjects chosen for the first set of experiments were selected from young male college students between the ages of 18 and 23 years on whom a careful study of the nasal passages had previously been made. At first, all subjects with distinct nasal abnormalities, such as septal deflections and hypertrophic rhinitis were excluded. It was found, as was to be expected, that very few of the men presented absolutely normal nasal passages. As experience demonstrated that these abnormalities did not materially affect the reactions obtained, such cases were later included in the majority of our observations.

The first studies were made on subjects changing from one atmospheric condition to another. We shall describe the method followed in Series A, Test 1, which is typical of the plan pursued in all experiments.

We worked four hours daily, a two-hour period from 9 to 11 a. m., and two hours in the afternoon, from 4 to 6 o'clock. In Test 1, where we studied the effect of the change from the normal room

to a hot room, with medium humidity, the subjects for the morning experiments reported at 8 a. m. and were placed in the normal room, where they remained for from one to two hours. At the end of this time each subject was examined in the normal room, a careful record of the examination made and a Glatzel plate record taken. The subjects were then placed in the hot experimental room, examined immediately, and a Glatzel plate record taken at the time when the greatest change was observed clinically. If no change was observed the Glatzel drawing was taken at the end of the session. During the morning experiments, the subjects were allowed to remain in the second experimental chamber (in Test 1, the hot room), for from one-half to one hour. In the afternoon session, the effect of the second atmospheric chamber (the hot room) was studied for one to two hours.

SUMMARY OF RESULTS OF EXPERIMENTS OF SERIES A.

Test 1. Studies on going from a normal room (68°, 50 per cent relative humidity), to a hot room (81°, 50 per cent relative humidity).

Twenty examinations made on men with normal noses, on going from a normal room into a hot room.

Seventeen cases gave an increase in the size of the left or right inferior turbinates, 8 on the left side, 13 on the right side, and 4 cases on both sides.

Fifteen cases showed increased redness.

Thirteen cases showed increased moisture. Four cases gave no moisture but gave redness.

Three showed no change at all.

One showed swelling and subsequent reduction of size of the right inferior turbinate.

At first we thought that there was a slight reddening of the pharynx and larynx in the hot room. Later observations showed that this change was so slight as to be almost negligible.

Test 2. Studies on going from a normal room (68°, 50 per cent relative humidity) to a cold room (45-50°, 50 per cent or less relative humidity).

Fourteen examinations made on subjects going from a normal room to a cold room.

Eight cases showed a reduction in size of the inferior turbinates, 4 on the right side, 4 on the left side.

Five cases showed decreased moisture; in one of these there was later noticed an increased amount of moisture.

Five cases showed a paling of the membranes.

Four cases showed no change in the cold room. Of these, 3 were observed for one hour and ten minutes.

One case showed a swelling of the right inferior turbinate which later decreased in size.

One case showed a swelling of the left inferior turbinate which produced contact with the septum.

Test 3. Studies on going from a normal room (68°, 50 per cent relative humidity) to a hot, dry room (80-86°, 20-30 per cent relative humidity).

Twenty examinations made in all, 10 on subjects with noses selected as normal, and 10 on subjects with noses abnormal.

Eleven cases showed a swelling of the inferior turbinates, 6 on the left side, 5 on the right side. In 2 cases there was contact with the septum.

Six cases showed decreased moisture of the membranes.

Five cases showed increased moisture of the membranes.

Eight cases showed increased redness of the membranes.

Three cases showed a reduction in the size of the left inferior turbinate.

One case showed no change.

The changes were observed to take place between 5 and 60 minutes after entering the hot, dry room.

As controls, two cases were kept under normal conditions throughout the experimental period. No changes were observed in them.

Test 4. Studies on going from a normal room (68°, 50 per cent relative humidity) to a hot, moist room (86°, 80 per cent relative humidity).

Twenty-three examinations in all, 12 on subjects selected as having normal noses, and 11 on subjects with abnormal noses.

Eighteen cases showed an increase in the size of the inferior turbinates 11 on the right side, 10 on the left side (of these, 3 swellings occurred on both sides).

Sixteen cases showed increased redness of the membranes. Of these, 11 were accompanied by increased moisture.

Fourteen cases showed increased moisture.

Eight cases had swelling of an inferior turbinate of sufficient extent to produce contact with the septum.

In 15 cases the subjects noticed increased difficulty in breathing through the swollen nostril.

Test 5. Studies on going from a hot room, medium humidity (80°, 50 per cent relative humidity) to a cold room, medium humidity (50°, 50 per cent relative humidity).

Twenty examinations made in all, 10 on subjects with normal noses, and 10 on subjects with abnormal noses.

Thirteen cases showed a reduction of the left or right or both inferior turbinates, 11 cases on the right side, 2 cases on the left side.

Three cases on both sides.

Eight cases showed decreased redness.

Seven cases showed decreased moisture.

One case showed swelling of the left inferior turbinate.

Five cases showed no change at all between 25 and 70 minutes after entering the cold room.

Seven cases showed an increase of the right or left inferior turbinate.

Five of these cases occurred simultaneously with a reduction in size of the inferior turbinate in the other nostril.

In about half the cases in which reductions in size of the inferior turbinates took place, decreased redness was also observed. Drying of the mucous membranes also accompanied half of the cases in which a reduction in the size of the inferior turbinate took place.

Drying, together with decreased redness, accompanied reduction in size of the inferior turbinates in four cases.

In almost one-third of the cases in which there was a reduction in the size of the inferior turbinate, the subjects themselves experienced easier breathing in the cold room.

The changes recorded above took place between 8 and 40 minutes after entering the cold room. The average time was 20 minutes. There was nothing distinctive regarding the reaction of the men with the "normal" noses as compared with the "abnormal" noses.

Test 6. Studies on going from a cold room, medium humidity (50°, 50 per cent relative humidity) to a hot, medium room (80°, 50 per cent relative humidity).

Thirty-four examinations made in all, 14 on normal subjects, and 20 on abnormal subjects.

Twenty-eight cases showed an increase in size of the inferior turbinates, of which 15 cases occurred on the left side, 8 cases occurred on the right side, and 5 cases occurred on both sides.

In 13 cases, in which swelling took place on the left side, the right inferior turbinate was reduced in size.

In 5 cases in which the inferior turbinate on the right side increased in size the left inferior turbinate was reduced in size.

Ten cases showed increased redness.

Five cases showed increased moisture.

One case showed decreased moisture.

Two cases had difficulty in breathing as a result of swelling.

Three subjects gave no change at all.

The change took place in from 5 to 65 minutes, generally after 20 minutes.

While it is evident from these results that the majority of cases react in a similar way, it should not be overlooked that there are exceptions to the rule, showing that the effect of these atmospheric changes on the nasal mucous membrane is by no means constant. This is not only true of this series but also of the others to be described later.

In general, the experiments of this series show that on passing from a normal or cold room into a hot room, there results usually an increase in color, moisture and size of the inferior turbinates and

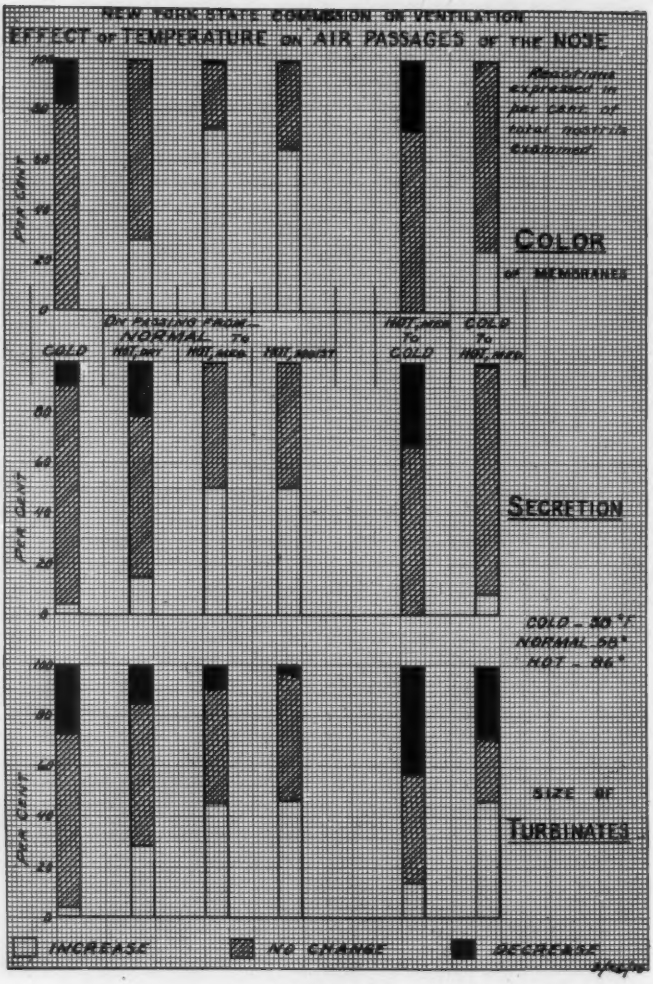
NEW YORK STATE COMMISSION OF VENTILATION
EFFECT OF TEMPERATURE ON AIR PASSAGES OF THE NOSE
COLOR
OF MEMBRANES
SECRETION
SIZE OF
TURBINATES
COLD
NORMAL
HOT
INCREASE
NO CHANGE
DECREASE

Chart 1.

nasal mucosa. Conversely, on going from a hot or normal room to cold, there is a decrease in color, moisture and size of the inferior turbinates in a large percentage of the cases.

These changes are shown schematically in Chart No. 1.

The percentage method employed in making this chart does not bring out the differences between cases of slight or moderate swelling of the inferior turbinates and cases of marked swelling where the increase in the size of the inferior turbinate produced contact with the septum. Chart No. 2 was made to show the ratio of the cases of marked swelling of the inferior turbinates to the total number of swellings observed. By referring to Chart No. 2 we see that the number of cases of marked swelling steadily increases as the percentage of atmospheric moisture increases.

This observation would appear of special importance when considered with the clinical findings later recorded in individuals accustomed for long periods of time, to hot, moist air (laundry workers).

Series B. Experiments in Air Movement. The second series of experiments was made to demonstrate the effect upon the nose of a current of air blown directly upon the face by fans. These studies were made in order to obtain information concerning the effects of drafts upon the nasal mucosa. There is such a wide variation of opinion upon the etiological importance of drafts in catarrhal affections of the upper air-passages that direct evidence upon this subject seems worthy of study. The summaries of the clinical examinations follow:

Test 1. Subjects examined in normal room (68°, 50 per cent relative humidity) after one-half to one hour and then removed to a hot, dry room (86°, 20-30 per cent) where they stayed with electric fans blowing directly on the face as soon as they entered. Changes observed from time to time.

Eighteen normal men examined in all.

Fifteen cases gave reduction in the size of the left, right or both inferior turbinates, of which 3 cases were slight reductions.

Nine cases gave increase in size of the right or left inferior turbinates. Three of these were slight. In 7 cases the increase occurred on the side opposite to the decrease.

Ten cases gave decreased mucus on one or both sides. There were 6 cases of increased mucus.

In one case no change took place, but this subject was examined in the hot room for a period of only 25 minutes.

The changes observed took place in from 15 to 55 minutes, the average time being 35 minutes.

Test 2. Subjects examined in normal room (68°, 50 per cent) in which they stayed one-half to one hour, then were removed to a

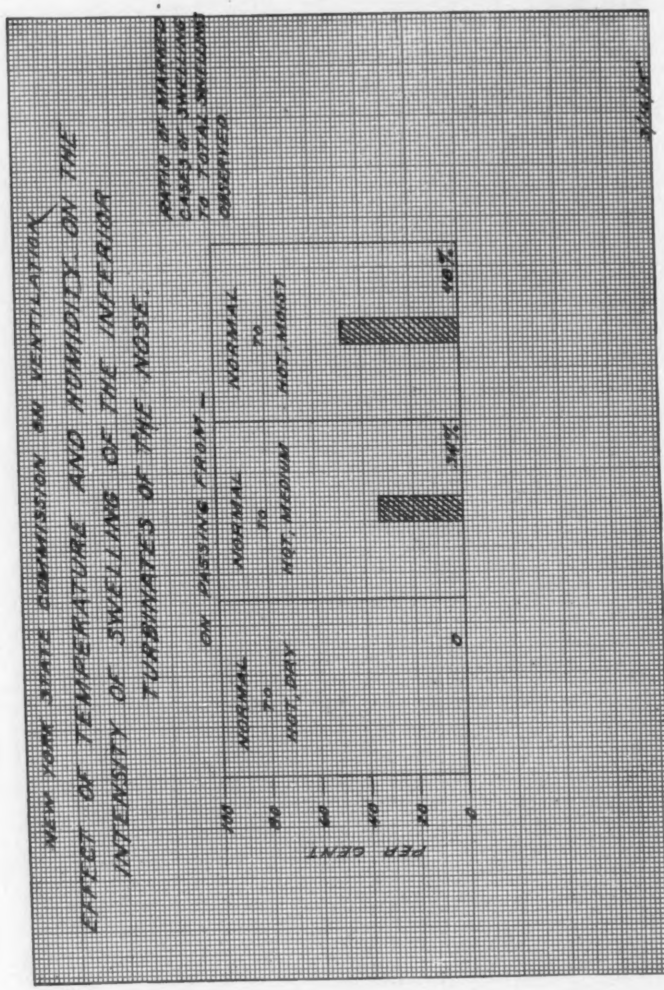
NEW YORK STATE COMMISSION ON VENTILATION
EFFECT OF TEMPERATURE AND HUMIDITY ON THE
INTENSITY OF SWELLING OF THE INFERIOR
TURBINATES OF THE NOSE
RATIO OF MARKED CASES OF SWELLING TO TOTAL SWELLINGS OBSERVED
ON PASSING FROM —
NORMAL TO HOT, DRY
NORMAL TO HOT, MEDIUM
NORMAL TO HOT, MOIST
0
34%
40%
PER CENT
100
80
60
40
20
0

Chart 2.

hot, moist room (86°, 80 per cent) where they stayed with electric fans blowing directly on the face. Changes observed from time to time.

Sixteen normal men examined in all.

Sixteen cases gave reduction in size of either the left or right or both inferior turbinates. In 15 cases this reduction was marked.

Ten cases gave increase in the size of the left or right inferior turbinates, but nearly all of these (7) were slight, and in those cases in which the increase was not recorded as slight, reduction in the opposite side was the important change. These increases occurred on sides opposite to which there were decreases.

Ten cases gave reduction of secretion. Only one case gave an increase, and in this case the increase took place in only one of the nostrils, the other nostril giving a decrease.

Test 3. Observations on subjects going from a hot, dry to a cold room (86°, 30 per cent, to 50°, 50 per cent) with fans blowing directly on the face in the cold room.

Eighteen observations on 8 different men.

Seventeen cases gave an *increase* in the size of the inferior turbinates, 5 on the right side, 4 on the left side, and 8 on both sides.

Six cases gave a *decrease* in the size of the inferior turbinates, either on the right or left side.

Fifteen cases showed increased secretion. Eleven of these showed increased secretion in both nostrils.

Two cases showed decreased secretion.

Eight cases gave a decrease in color (6 of these in both nostrils).

Two cases gave increased redness (color) in one nostril only.

The changes observed took place in from 16 to 85 minutes, the average time being 38 minutes.

Test 4. Observations on subjects going from a hot, moist room to a cold room, with fans blowing directly on the face in the cold room.

Twenty-five observations on 8 different men.

In 23 cases an increase in the size of the inferior turbinate was observed, (7 on the right side, 5 on the left side, 10 on both sides). Fourteen of these increases were marked.

Six cases gave a decrease in the size of the inferior turbinate on one side.

All 25 cases showed increased secretion. In all but one case the increased secretion took place on both sides.

Twenty-five cases showed decrease in color, which was bilateral 21 times.

Inasmuch as it may be presumed that the physical effects of drafts upon the nasal mucous membrane is to facilitate the rapidity of heat loss, it was to be expected that the results of drafts might be the same as the effects of cold. Our results of Test 1 bear out this supposition. Here the characteristic change was a reduction of the size of the turbinates accompanied by a diminution of the secre-

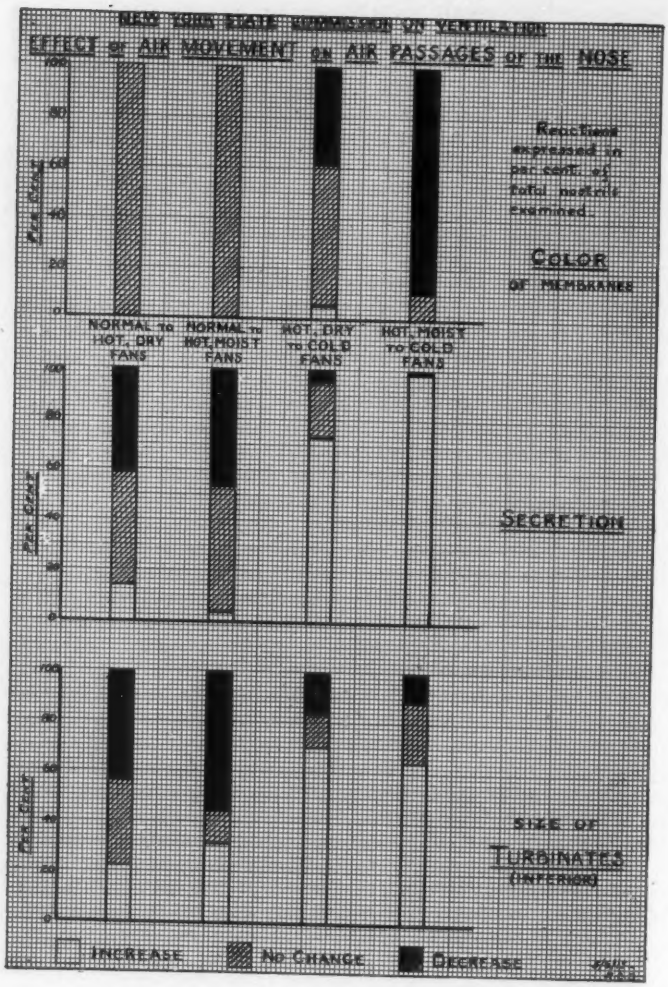
NEW YORK STATE COMMISSION ON VENTILATION
EFFECT OF AIR MOVEMENT ON AIR PASSAGES OF THE NOSE
Reactions expressed in per cent. of total number examined.
COLOR OF MEMBRANES
SECRETION
SIZE OF TURBINATES (INFERIOR)
NORMAL to HOT, DRY FANS
NORMAL to HOT, MOIST FANS
HOT, DRY to COLD FANS
HOT, MOIST to COLD FANS
INCREASE
NO CHANGE
DECREASE

Chart 3.

tion, which corresponds closely to the results obtained in Test 2 of Series A, i. e., on passage from a normal to a cold room.

In Tests 3 and 4 of Series B, where the subjects were exposed to drafts in a cold room after previous exposure to a high temperature at a low and high humidity respectively, the changes were radically different, showing an almost uniform increase in the size of the turbinates and increased secretion. These results were not anticipated and call for further investigation and corroboration. It would appear, from these results, that after exposure to high temperatures, the effect of drafts is distinctly marked in producing a condition of the mucous membrane especially favorable to the development of infectious micro-organisms. (See Chart No. 3.)

Series C. Skin Reflexes. Examination of Subjects with Body in One Room and Head in Another, Having a Different Temperature. A third set of observations (Series C) was made on 57 cases with the body of the subject in one room under certain conditions, while the head protruded into a second room with markedly different atmospheric conditions. The object was to study the reflex action upon the mucous membranes of stimuli derived from the surface of the body.

It was noted that there was a very considerable increase in the size of the inferior turbinates in a large number of cases, quite independent of the atmospheric condition.

A fourth set of experiments (Series D), was attempted in order to elicit further information concerning this reflex action.

In 42 cases with the body exposed to one temperature, either warm or cold, the feet were immersed in a bath of markedly different temperature. Here again the results were inconclusive, the experiments failing to show any striking or uniform effect upon the shrinkage or swelling of the turbinates and nasal mucosa.

The summaries of the window and skin reflex tests are given below, for the sake of completeness, in spite of the lack of uniformity exhibited in the results.

SUMMARY OF CLINICAL RESULTS.

Test 1. Body of subject in normal room (68°, 50 per cent relative humidity), head in cold room (45-50°, 50 per cent relative humidity).

Thirteen cases in all, 8 A* subjects and 5 B subjects.

Two showed no change at all (B subjects).

One case gave a reduction of the right inferior turbinate.

*The "A" subjects are men with practically normal noses. The "B" subjects are men with nasal irregularities, such as turbinate hypertrophies, deflections of the nasal septa, etc.

Ten cases gave an increase in size of the inferior turbinates, 3 on the left side, 3 on the right side, 4 on both sides.

Of the 10 cases of swelling of inferior turbinates, 3 gave some reduction of the inferior turbinate after it had become enlarged. These all occurred on the left side.

The changes began to take place between 6 and 45 minutes after head was placed through the window.

Test 2. Body in normal room (68°, 50 per cent relative humidity) and head in hot room (86°, 50 per cent relative humidity).

Eight cases in all, 3 A subjects and 5 B subjects.

Two subjects (B) showed no change at all.

Six cases showed increase in size of the inferior turbinates, one on the left side, two on the right side, three on both sides.

Of the 6 cases of swelling of the inferior turbinates, 2 gave a decrease in the size of the turbinate after it had become enlarged; 2 gave swellings with a reduction of the inferior turbinate on the opposite side.

The changes were observed between 6 and 20 minutes after the head was placed through the window.

Test 3. Body in cold room (45-50°, 50 per cent relative humidity), subject stripped to waist to underclothes, head in normal room (68°, 50 per cent relative humidity).

Nine cases in all, 5 A subjects, 4 B subjects.

All showed increase in size of the inferior turbinate, one on the right side, 4 on the left side, and 4 on both sides.

Of the 9 cases of swelling, one case gave a marked swelling on the left side, followed by a marked reduction.

One case gave swelling on the right side, followed by a slight reduction.

Three cases gave increased color.

Three cases gave increased secretion.

The changes took place between 2 and 35 minutes after the head was placed through the window.

Test 4. Body (stripped to underclothes to the waist) in cold room (50° or less, 50 per cent relative humidity), head in hot room (86°, 50 per cent).

Nine cases in all, 4 A subjects and 5 B subjects.

Four cases gave increased redness.

Four cases gave increased secretion.

Eight cases showed increases in the size of the inferior turbinates, of which 3 were on the right side, 3 were on the left side and 2 were on both sides.

The changes took place between 9 and 40 minutes after the head was placed through the window.

Test 5. Body in hot room (86°, 50 per cent relative humidity), head in normal room (68°, 50 per cent relative humidity).

Nine cases in all, 4 A subjects and 5 B subjects.

One case showed no change at all.

Two "A" subjects gave increased redness (in one of these this was the only change).

One "A" subject gave decreased redness (this was the only change noticed in this subject).

Three subjects gave increased mucus.

Five subjects gave swelling of the inferior turbinates. 2 on the right side, 2 on the left side, and 1 on both sides.

Of these 5 swellings, 2 cases on the left side gave reductions on the right side. One case of swelling on the right side gave a slight reduction on the left.

One case gave a reduction on the left side only.

These observations were noted 1-50 minutes after the head was placed through the window.

Test 6. Subjects in hot room (86°, 50 per cent relative humidity), head in cold room (45-50°, 50 per cent relative humidity).

Nine cases in all, 4 A subjects and 5 B subjects.

Four subjects gave diminished color.

Five gave diminished secretion.

Two gave an increase in secretion; one of these later gave a decrease.

Seven cases gave increases of inferior turbinates, 4 on the right side, 1 on the left side, and 2 on both sides.

Eight cases of reduction of inferior turbinates, 5 on the right side, 2 on the left side.

Two reluctions were followed by swellings of the same turbinate.

Four reductions occurred in the nostril opposite to the one with the swollen inferior turbinate.

These changes took place in from 1 to 44 minutes after the head was placed through the window.

SUMMARY OF THE WINDOW CONTROL OBSERVATIONS.

Owing to the construction of the two experimental chambers, the position of the subjects during the experiments was such that the head was inclined forward and slightly below the vertical. It was suspected that this slight change in posture might be responsible for the almost constant increase in size of the turbinates. We therefore made 9 window control observations with the two rooms maintained at the same temperature (68° F., 50 per cent relative humidity). The men were kept in the window in the majority of instances from 45 to 65 minutes.

The changes observed were very slight and practically negligible as compared with the changes observed when the temperature conditions in both rooms were not identical.

Series D. Summaries of Clinical Examinations of Foot-Bath Experiments.

Test 1. Body in cold room (45-50°, 50 per cent), feet immersed in hot water, 110°, for one-half hour.

Ten cases in all, 5 A subjects, 5 B subjects.

Two subjects showed no change at all (1 A and 1 B subject).

Three showed increased secretion.

One showed increased redness.

One showed reduction in size of both inferior turbinates after three minutes.

One showed a reduction of the right inferior turbinate after one hour.

Six cases showed increase in size of the inferior turbinates, 2 on the left side, 2 on the right side, and 2 on both sides. Of the 6 cases of swelling, 1 had swelling with reduction on the opposite side, 1 had swelling on both sides after a reduction on both sides.

The changes were observed between 2 and 25 minutes after the feet were placed in the bath. (This excludes the 1 hour change noted above.)

Test 2. Body in hot room (86°, 50 per cent relative humidity) and feet in cold water (50°).

Nine subjects in all, 4 A subjects, 5 B subjects.

One case showed a slight swelling of the inferior turbinate on the left side in thirty minutes.

One gave a decrease in color and secretion.

Eight gave reductions of the inferior turbinates. Of these, 6 cases gave reduction of the right inferior turbinate with swelling of the opposite sides. The swelling was usually slight; the reduction was more marked. One of these 6 cases gave a reduction on both sides. One case gave a reduction of the left inferior turbinate. (This was the case with the diminished color and secretion).

One case gave a slight reduction on the right side and then a slight swelling.

The time of change was 2 to 30 minutes after immersion in the cold bath.

Test 3. Body in normal room (68°, 50 per cent relative humidity), feet immersed in hot water, 110°, for half an hour.

Eleven cases in all, 6 A subjects, 5 B subjects.

One B subject showed no change at all after thirty-five minutes.

Seven cases gave a reduction of an inferior turbinate on one side, accompanied by a swelling of the opposite side.

One case gave marked reduction on the left side.

One case gave a marked increase on right side.

One case gave increase on both sides.

Of the 7 cases of reduction and swelling, 3 gave a marked reduction of the right inferior turbinate, accompanied by a slight swelling on the right side, an appreciable swelling and a marked swelling.

One case gave a reduction on the right and later an increase on the left side.

Three cases gave reductions on both sides. One was followed by an increase on the left side; one, in which the reduction was pronounced on the left side, was followed by an increase on the right side.

These changes took place 1 to 12 minutes after the feet were placed in the water bath.

Test 4. Subject in normal room (68°, 50 per cent relative humidity), feet immersed in cold water bath, 50°, one-half hour.

Twelve cases in all, 7 A subjects, and 5 B subjects.

One case showed no change at all (after thirty-five minutes).

One case gave an increase in moisture after fifteen minutes; then a decrease.

One case gave increased secretion.

Seven cases gave an increase in size of the inferior turbinates, 5 on the right side, 1 on the left side, 1 on both sides. Two of the swellings on the right side were marked. One case of swelling on the left side was marked. All the others were slight.

Of the 7 cases of swelling, 1 with a swelling on the left side gave a reduction of the inferior turbinate on the right side.

One with a slight swelling on the right side gave a slight reduction of the left side after one hour and five minutes.

Two cases with marked swelling on the right side gave a reduction on the left side.

One case gave a reduction on both sides after two minutes, the left side later returning to the original condition before the reduction took place.

One case gave a reduction on the right side which later went back to its original normal condition.

From these results, it is apparent, as already stated, that the lack of uniformity makes it impossible to draw any definite conclusions of the effect upon the nasal mucous membrane produced by changes of temperature exerted upon the surface of the body, as opposed to direct action upon the upper air-passages. This lack of uniformity would tend to show that reflexes from the skin are much less important in producing changes in the nose than is the direct effect of changes of atmospheric conditions acting directly upon the nasal mucosa.

STUDIES OF WORKERS IN SPECIAL OCCUPATIONS.

It was thought desirable to investigate what changes, if any, were produced in the nose and throat by prolonged exposure to extreme atmospheric conditions, and to observe the reactions occurring in such subjects when exposed to atmospheric changes similar to those studied in normal individuals. For this purpose certain occupational groups were selected as follows:

1st Group, Series E. Workers in dry heat (boiler rooms, etc.).

2nd Group, Series F. Outdoor workers (truckmen, drivers, etc.).

3rd Group, Series G. 1. Cases of atrophic rhinitis representing steam laundry workers (moist heat).

Group I. Men Accustomed to Dry Heat (Engineers, Firemen, Boiler Makers, etc.).

Test 1. Observations on subjects on going from a hot, dry, to a cold room (86°, 20 per cent, to 50°, 50 per cent).

Twelve observations on 6 different men.

In 10 cases there was a unilateral swelling of the inferior turbinate. Five of these were slight swellings. Six of the 10 increases occurred on the right side, and 4 occurred on the left side. One case of the 10 had swellings of both inferior turbinates.

In 6 cases of the entire 12 there was a decrease in size of the inferior turbinate noted on one side, 3 on the left side, 3 on the right side; 2 of these decreases were slight.

Three cases of the 12 gave increased secretion in both nostrils.

One case gave increased secretion on one side, and another gave decreased secretion on one side.

One case gave an increase in color on one side, and another case gave a decrease in color on one side.

Test 2. Observations on subjects on going from a cold to a hot, dry room (50°, 50 per cent, to 86°, 20 per cent).

Twelve observations on 7 different men.

In 12 cases a decrease in size of the inferior turbinate on one side was observed. Six took place on the right side and 6 on the left side. Of these 12 decreases, 3 were marked and 3 were slight.

In 10 cases an increase in size of the inferior turbinate on one side was observed. Five of these took place on the right side and 5 on the left side. Four of these 10 increases were marked, and 2 were slight.

Ten of the 12 subjects had an increase in size of the inferior turbinate on one side, accompanied by a decrease in size of the inferior turbinate on the opposite side.

Four cases of the 12 gave a decrease in secretion, 1 case on the right side, and the other 3 cases on both sides.

Four cases gave an increase in secretion, 3 of these on ane side, and the other case on both sides.

Three cases in all gave an increase in color; 2 cases on one side, and the other case on both sides.

Test 3. Observations on subjects on going from a hot, very moist room, to a cold room (86°, 80 per cent, to 50°, 50 per cent).

Eleven observations on 6 different men.

In 10 cases an increase in the size of the inferior turbinate was observed on one side. Three of these occurred on the left side, and the other 7 on the right side. Three of the 10 increases were slight.

In 8 cases of the 11 a decrease in size of the inferior turbinates (right or left side) was observed. Seven cases occurred on the right side, and 1 case gave the decrease on both sides. Four of the 8 decreases were slight.

Four cases gave a decrease in the amount of secretion (1 on the right side only, and the other 3 cases on both sides).

Five cases gave an increase in secretion, 4 of these occurring on one side, and the other on both sides.

Seven cases were observed to give a decrease in color of the membranes. Three of these cases had the decrease on one side and 4 on both sides.

NOTE.—Seven cases out of the entire 11 had an increase in size of the inferior turbinate on one side, accompanied by a decrease in size of the inferior turbinate on the other side.

Test 4. Observations on subjects on going from a cold to a hot very moist room (50°, 50 per cent, to 86°, 80 per cent).

Ten observations on 6 different men.

Eight cases gave a decrease in size of the inferior turbinate on one side or on both sides. (3 on right side, 3 on left side, and 2 on both sides). One decrease was slight, and 3 were marked.

Seven cases gave an increase in size of the inferior turbinate. Three of these occurred on the right side, 3 on the left side, and 1 on both sides. Three of these 7 swellings were slight, and 3 were marked.

In 6 of the entire 10 cases, an increase in size of the inferior turbinate on one side was accompanied by a decrease in size of the inferior turbinate on the opposite side.

In 4 cases an increase in secretion was observed (3 on one side, and 1 on both sides).

In 2 cases a decrease in secretion was observed (1 on one side, and 1 on both sides).

In 9 cases an increase in color was observed (2 on one side and 7 on both sides).

Group II. Men Accustomed to Outdoor Work (Truckmen, Drivers, etc.).

Test 1. Observations on subjects on going from a hot, dry, to a cold room (86°, 20 per cent, to 50°, 50 per cent).

Thirteen observations made on 7 different men.

In 12 cases an increase in size of the inferior turbinates was observed; 11 on one side and 1 on both sides. Five of these increases were slight, and 1 was marked.

In 7 cases a decrease in size of the inferior turbinate on one side was observed. Two of these 7 cases were slight decreases.

Five cases showed increased secretion, 4 of these occurring on one side, and 1 on both sides.

One case gave decreased secretion.

Four cases gave a decrease in color; 2 of these occurred on one side, and 2 on both sides.

Test 2. Observations on subjects going from a cold to a hot, dry room (50°, 50 per cent, to 86°, 20 per cent).

Fifteen observations on 8 different men.

Thirteen cases gave a decrease in size of the inferior turbinates, 12 on one side, and 1 case on both sides. Seven of these were slight changes.

Ten cases gave an increase in size of the inferior turbinates. All took place on one side only. Eight of the 10 increases were slight.

In 9 cases an increase in size of an inferior turbinate on one side was accompanied by a decrease in size of the inferior turbinate on the opposite side.

In seven cases a decrease in secretion was observed. Two cases gave a decrease in secretion on one side, and 5 on both sides.

In 1 case an increase in secretion was observed.

In 4 cases an increase in color was observed on both sides. The other cases gave no change in color.

One case of the 15 showed no change at all in the hot room after being under observation for seventy-two minutes.

Test 3. Observations on subjects going from a hot, moist, to a cold room (86°, 80 per cent, to 50°, 50 per cent).

Seventeen observations on 9 different men.

In 16 cases an increase in size of the inferior turbinate was observed, 4 on the right side, 5 on the left side, and 7 on both sides. Nine were slight increases.

In 6 cases a decrease in size of the inferior turbinate was observed, all on one side. Three of the 6 were slight decreases.

Five cases which had an increase in size of the inferior turbinate on one side had a decrease in size of the inferior turbinate on the opposite side.

Nine cases gave increased secretion, 3 on one side, and 6 on both sides.

Three cases gave decreased secretion on one side.

In 13 cases of the 17, a decrease in color of the membrane was observed, 6 cases on one side, and 7 on both sides.

Test 4. Observations on subjects going from a cold to a hot, very moist room (50°, 50 per cent, to 86°, 80 per cent).

Thirteen observations on 9 different men.

Except for 4 nostrils in which increases in size of the inferior turbinate were observed, all changes in size were slight.

In 11 cases an increase in size of the inferior turbinates was observed; 6 on the right side, 4 on the left side, and 1 on both sides.

In 10 cases a decrease in size of the inferior turbinates was observed. All of these took place on one side only. All were slight decreases.

In 8 cases an increase of an inferior turbinate on one side was accompanied by a decrease in size of the inferior turbinate on the other side.

Seven cases gave increased secretion, 5 on one side, and 2 on both sides.

Two cases gave decreased secretion on one side only.

Twelve cases of the entire 13 gave an increase in color. Nine cases had the increased color on both sides.

Group III. Men With Atrophic Rhinitis.

Test 1. Observations on subjects on going from a hot, dry, to a cold room (86°, 20 per cent, to 50°, 50 per cent).

Twenty-one observations on 7 different men.

In 19 cases an increase in size of the turbinates (inferior) took place (18 cases on one side and 1 case on both sides). Nine of these were slight.

In 14 cases a decrease in size of the inferior turbinate was observed. All of these took place on one side. Seven were slight decreases.

In 12 cases an increase of an inferior turbinate on one side was accompanied by a decrease in the size of the inferior turbinate on the opposite side.

TABLE SUMMARIZING CLINICAL CHANGES OBSERVED IN THE AIR PASSAGES OF 4 GROUPS OF MEN ON GOING FROM ONE ATMOSPHERIC CONDITION TO ANOTHER.

(The figures are expressed in per cent of total nostrils examined.)

Group E. Men accustomed to dry heat (furnace men, boiler makers, etc.).
Group F. Men accustomed to out door conditions (truckmen, drivers, etc.).
Group G. Men with atrophic condition of the air passages as found in laundrymen.
Series A. Students used in the tests earlier in the work.

		No. of Cases	Change in Size of Inferior Turbinates. Inc.	Dec.	Un.	Change in Secretion Inc.	Dec.	Un.	Change in Color Inc.	Dec.	Un.
Gr. E.	Hot, dry to cold	12	50	25	25	29	4	67	4	4	92
Gr. F.	" " " "	13	50	27	23	23	4	73	0	23	77
Gr. G.	" " " "	21	52	37	11	39	21	40	0	83	17
Ser. A.	" med. " "	20	14	43	43	0	33	67	0	28	72
Gr. E.	Cold to hot, dry	12	42	50	8	21	29	50	17	0	83
Gr. F.	" " " "	15	33	46	21	3	40	67	26	0	74
Gr. G.	" " " "	18	48	42	10	3	77	20	65	3	32
Ser. A.	" " " med.	34	46	29	25	9	1	90	24	0	76
Gr. E.	Hot, moist-cold	11	45	41	14	25	32	43	0	50	50
Gr. F.	" " "	17	67	18	15	44	12	44	0	58	42
Gr. E.	Cold-hot, moist	10	40	50	10	25	15	60	80	0	20
Gr. F.	" " "	13	47	39	14	35	8	57	82	0	18

Group 3 was not put through the last two above conditions.

The atmospheric conditions of the experimental rooms for Series A were somewhat different from the above. The results are given below for comparison.

SERIES A.

	Normal to cold	14	4	28	68	4	10	86	0	18	82
1.	Normal to hot, dry	20	28	15	57	15	22	63	28	0	72
2.	Normal to hot. med.	20	45	10	45	50	0	50	73	2	25
3.	Normal to hot, moist	23	46	4	50	50	50	0	65	0	35

In 11 cases increased secretion was observed, 7 on one side, and 4 on both sides.

In 5 cases decreased secretion was observed, of which 2 cases had the decrease in one nostril, and 3 in both nostrils.

In 18 cases of the 21, a decrease in color was observed. Fourteen gave this paling of the membranes in both nostrils.

Test 2. Observations on subjects going from a cold to a hot, dry room (50°, 50 per cent, to 86°, 20 per cent).

Eighteen observations on 7 different men.

In 17 cases an increase in the size of the inferior turbinate was observed. All of these took place on one side. Seven of these were slight.

In 15 cases a decrease in the size of the inferior turbinates was observed. Five of these decreases were slight.

In 15 cases an increase in size of the inferior turbinate on one side was accompanied by a decrease in the size of the inferior turbinate on the other side.

Fourteen cases gave decreased secretion. Thirteen cases had the diminished secretion on both sides.

One case gave increased secretion.

Thirteen cases gave an increase in color of the membranes; 10 of these cases were on one side, and 3 on both sides.

One case gave decreased color of the membranes.

By referring to the foregoing table, we find an accurate summary of the results obtained in our experiments. There are several striking differences between the reactions of the normal students (Series A) and those observed in the three occupational groups.

Attention is particularly called to the increase in the size of the inferior turbinates of the three occupational groups on going from the hot, dry, to the cold, the opposite of the reaction obtained in the normal group. The occupational groups furthermore show increased secretion under the same conditions. This again is contrary to the reaction observed with the normal men.

The two occupational groups, Group E, and Group F, show practically the same reactions on going from the hot, moist, to the cold, that they exhibit on passing from the hot, dry, to the cold.

In going from the cold to the hot, dry, the characteristic change in the occupational groups is a shrinkage of the inferior turbinates accompanied by a decrease in the amount of secretion (with the exception of the turbinate change in Group G), the contrary of the reactions obtained with the normal men.

From these results it would appear that not only are definite changes produced in the nasal mucous membranes by prolonged exposure to extreme atmospheric conditions, but also that as a result of these changes the reactions to atmospheric variations are distinctly altered.

The Effect Upon the Nose of Long Continued Exposure to Dry Heat and Moist Heat. After finishing the studies of the direct and immediate effects of various atmospheric conditions upon the nasal structures, we investigated the nasal conditions in workers, who, by reason of their occupations, were exposed for long periods of time to dry heat and moist heat.

The figures elicited are so striking that they appear worthy of serious consideration.

Fifty-eight students were first examined to select candidates for the subjects used in the experiments already reported in Series A. The ages of these men, the majority of whom were Hebrews, varied from 18 to 23 years. Among the lot were two cases of atrophic rhinitis. Most of them had spurs, deflected septa, adenoids, hypertrophied tonsils, etc.

The next group examined consisted of 27 outdoor workers, drivers, teamsters, postmen, etc. Ages, 19 to 60 years. In this group there were 5 cases of atrophic rhinitis, one of which occurred in a 60-year-old man, which was probably a case of senile atrophy. Three additional cases had reddened and dry membranes.

Of 26 workers in hot, dry air (boiler-room men, engine-room men, stationary engineers, etc.), there were 9 cases of atrophic rhinitis and 9 additional cases with reddened and dry nasal membranes which were not sufficiently advanced to call them atrophic rhinitis.

In our experimental studies we found that the most pronounced immediate reactions were obtained in the hot, moist room. When we came to examine the laundry workers, we found that they showed by far the largest percentage of cases of atrophic rhinitis of any of the groups. The results follow:

Summary of Clinical Observations on the Conditions of the Air-passages of the Nose and Throat of Forty-six Laundry Workers Examined While on Duty in Two Laundries in New York City. The laundry workers are here divided into four groups, 1, 2, 3 and 4, Group 1 being those most exposed to hot, moist air, and steam; Group 2 next in order, and so on to Group 4, which is hardly exposed to moisture at all.

Group 1. Twelve workers, 4 males, 8 females, ages 18-40 (2 washers, 2 clothes wringers, 8 mangle feeders). Employed at this work over periods of 1 to 15 years.

Seven of the 12 had atrophic rhinitis, both sides. Two were slight.
One had a slight unilateral atrophic rhinitis.
Two had a tendency toward atrophic rhinitis.
One had a possible unilateral atrophic rhinitis.
One case was doubtful.
Four of the 12 cases had atrophic pharyngitis.

Group 2. Thirteen workers, all starchers, 7 males, 6 females, ages 17-35. At work 1-13 years. Nationality, Irish, Russian, Slav, Italian, Polish, American.

Seven had atrophic rhinitis, both sides.
One had a possible atrophic rhinitis.
One had a cold and could not be classified.
Two were normal.
Three had atrophic pharyngitis.
Two had unilateral atrophic rhinitis, but factors other than the occupational surroundings seemed to be responsible for the lesion in these two cases.

Group 3. Eight workers, 2 males, 6 females. Ages 19-39. At work 2-8 years. Different nationalities.

Five had bilateral atrophic rhinitis (2 were slight).
One had a one-sided atrophic rhinitis.
Two were normal.
Two had atrophic pharyngitis.

Group 4. Thirteen miscellaneous workers, overseers, packers, markers of clothes, sorters of clothes. Least exposed to hot, moist air. Eight males, 5 females. Ages 19-40. At work 4 months to 20 years. Different nationalities.

Five were normal.
Two had atrophic rhinitis, both sides.
Two had atrophic rhinitis of one side.
Two had colds with a possible atrophic condition on both sides.
One was doubtful.
One had dryness of membranes.

Of the 33 workers who comprise the first three groups, 21, or 63 per cent, had atrophic rhinitis of one or both nostrils.

Table Showing Incidence of Cases of Atrophic Rhinitis.

TABLE SHOWING INCIDENCE OF CASES OF ATROPHIC RHINITIS.

Group	Number of Cases Examined	Number of Cases of Atrophic Rhinitis	Percentage of Atrophic Cases
Students	58	2	3.4
Workers in Dry Heat	26	9	34.6
Out-door Workers	27	5	18.8
Workers in Moist Heat (laundries)	46	21	45.6

NOTE.—If we exclude those laundry workers not actually working among very moist surroundings, we find that 21 out of 33 examined, i. e., 63 per cent, have atrophic rhinitis.

Mr. Crittenden, of the staff of the New York State Commission on Ventilation, kindly furnished us with the following tables of temperature and humidity records taken in various steam laundries, boiler and engine rooms, in New York City.

While the average humidity of the various laundries is but 51.3 per cent, it will be seen from the table that the relative humidity in

the washing-room of the Champion Laundry, a modern building, well equipped with large windows and fans, reaches 71 per cent. In the Dillon Laundry, the relative humidity taken near the washing machine was also 71 per cent. Investigation of the laundry plants shows that steam comes directly up into the faces of the workers standing near the mangles, washing machines and other appliances much of the time. In fact, we feel certain that these steam laundry workers are far more exposed to high degrees of humidity than the figures indicate.

The second table shows that the average atmospheric conditions in a large number of boiler and engine rooms is 80.2 F., with 26.5 per cent relative humidity. In summer the temperature is very much higher.

TEMPERATURE AND HUMIDITY IN LAUNDRIES. RECORDS TAKEN WITH SLING PSYCHROMETER.

Place.	Room.	Feb. 19, 1915. D.B.	W.B.	R.H.
Champion Laundry	Washing	69	63	71
452 W. 55th St.	Ironing and Drying	72	57	38
	Ironing	70	58	44
Dillon Laundry Co.	Front of washing machine	83	76	71
56th St. bet. 10th & 11th Aves.	do. mangles and dryers	83	68	45
Elite Laundry	Washing	76	65	53
	Front of mangle and dryer	74	61	46
Brown Steam Laundry	Front of washers	75	60	43
56th St. beg. 10th & 11th Aves.	Ironing and Drying	75	60	40
Yale Laundry Co.	In front washers	75	65	60
540 W. 58th St.	Ironing mangle and dryers	74	62	53
	Total	826	695	564
	Average	75.1	63.5	51.3

NOTE.—D.B. = Dry bulb temperature.
W.B. = Wet bulb temperature.
R.H. = Relative humidity.

AIR TEMPERATURE AND HUMIDITY READINGS IN BOILER AND ENGINE ROOMS.

Place.	Room	Feb. 19, 1915. D.B	W.B.	R.H.
City Investment Bldg.	Engine	78	58	27
165 Broadway.	Boiler	64	51	36
Vanderbilt Hotel	Engine	91	65	21
34th St. & Park Ave.	Boiler	81	60	24
B. Altman & Co.	Engine	82	58	20
34th St. & 5th Ave.	Boiler	74	56	31
McCreery's	Engine	79	64	33
34th St. & 5th Ave.	Boiler	75	57	31
Gimbels.	Engine	81	59	24
32nd St. & 6th Ave.	Boiler	80	59	26
Saks & Co.	Engine	80	59	27
32nd St. & 6th Ave.	Boiler	80	61	32
R. H. Macy	Engine	85	60	16
Bway. & 34 St.	Boiler	76	56	26
Lord & Taylor	Engine	84	61	25
5th Ave. & 36th St.	Boiler	97	70	24
Hotel Waldorf	Engine	80	60	26
34th St. & 5th Ave.	Boiler	75	57	27
	Total	1442	1070	476
	Average	80.2	59.5	26.5

From the records and clinical studies at hand, it seems fair to assume that moist heat produced more swelling, more redness and a greater amount of secretion than dry heat, in the case of normal individuals. We have also shown that there is a steadily increasing percentage of cases of atrophic rhinitis present among the three

classes studied, outdoor men, stationary engineers, laundry workers, most marked with the last group, where the percentage of relative humidity is highest.

In view of the studies of Perez, who has isolated the Coccobacillus foetidis, which he believes is the causative agent of ozaema, and in view of the contagiousness of oxaema which Perez has demonstrated both bacteriologically and clinically, we must not forget that contagion may be an additional factor in the production of atrophic rhinitis among laundry workers.

Experimental Observations on the Larynx and Trachea of Dogs Subjected to Peripheral Stimulation by Means of Heat and Cold Applied to the Surface of the Body. We have already alluded to the studies of Rossbach and Aschenbrandt, who found that vasomotor contraction of the skin vessels due to cold was accompanied by reflex dilatation and congestion of the tracheal vessels which is thought to be an indirect cause of many of the so-called "cold" diseases.

Meuzer believes that these observations of Rossbach and Aschenbrandt are of little value because the trachea was opened and consequently directly exposed to the outside air.

Through the courtesy of Prof. Frederic S. Lee, of the College of Physicians and Surgeons, and with the assistance of Dr. Pike, we attempted to verify these observations.

The experiments were performed on dogs narcotized with chloroform, or urethane, and in one instance upon a decerebrated animal.

The room in which the experiments were performed was heated to 80° F., so that only warm air could come into contact with the trachea. Instead of opening the trachea, a bronchoscope was used for studying the changes.

Observations were made on four different dogs. The changes observed were too uncertain for us to be able to substantiate the claims of Rossbach and Aschenbrandt.

The records of the experiments follow:

Experiment 1. March 11, 1915. Dog deeply anesthetized with urethane and morphine. Temperature of room approximately 80° F. Hot cloths applied to abdomen 15 minutes, followed by the application of cold 10 minutes, again followed by heat. No change observed in larynx or trachea by means of bronchoscope.

Experiment 2. March 18, 1915. Employed chloroform anesthesia, as it was thought that the profound narcosis induced by urethane might have interfered with the vaso-motor reflexes in the previous experiment. 1. Hot compresses to abdomen 15 minutes.

No reaction. 2. Change to cold. Continued 15 minutes. Immediate blanching of the larynx gradually less marked. 3. All compresses removed. Increased secretion immediately, also increased redness. Changes observed through bronchoscope.

Experiment 3. March 25, 1915. Chloroform anesthesia. 1. Hot compresses to abdomen 7 minutes. Slightly increased secretion. 2. Changed to cold compresses 15 minutes. Possible slight blanching of larynx. No change in trachea.

Experiment 4. April 1, 1915. Dog decerebrated by Dr. Pike. 1. Heat to abdomen. Increased moisture with possibly increased redness. 2. This reaction continued when cold was applied. Observations made with bronchoscope.

Experiment 5. 1. Using the same dog employed in Experiment 4, the trachea was opened. No change with heat or cold could be observed. 2. Cold air was blown upon the exposed trachea by means of a long rubber tube connected with a compressed air pump. This produced dryness of the trachea (due to evaporation) accompanied by some redness. The moisture returned as soon as the air douche was discontinued. 3. The experiment was repeated with the same results.

These observations appear to be too variable and uncertain to warrant our basing any definite conclusions upon them and do not corroborate the results recorded by Rossbach and Aschenbrandt.

Summary and Conclusions. Our clinical experiments demonstrate that distinct changes in the mucous membranes of the nose result from changes of air temperature and humidity. In the majority of instances the reaction is one of increased swelling, moisture and redness from heat, and the reverse from cold.

The effect of air blown directly upon the face by fans greatly modifies the changes observed. On going from the cold to the hot room with fans, there is a decrease in the size of the inferior turbinate and in the amount of moisture. The characteristic change on passing from the hot to the cold condition with fans, is an increase in the turbinates and secretion.

It was further observed that moist heat produces greater changes than dry heat, while the highest percentage of cases of atrophic rhinitis was found among long-time workers in hot, moist rooms (steam laundries).

The window and foot bath experiments tend to show that the reaction of the nasal structures to atmospheric changes is primarily direct and local and not reflex, although the evidence on this point is inconclusive.

It must be remembered that turbinate reactions are very delicate

and that the changes we have observed are by no means constant. It would appear, however, that the reactions in the nasal mucous membranes produced by changes in atmospheric environment are too frequent and too definite to be disregarded. Consequently we are convinced that the theory of bacterial infection as the sole cause of catarrhal inflammations of the upper air-passages is not tenable, since the changes produced by environment must materially affect the incidence of infection.

This whole problem is a very difficult and complex one, and our observations are presented as a contribution to the knowledge of this subject which demands considerable additional investigation in order to place it on a definite scientific basis.

The writer wishes to express his appreciation of the assistance of Dr. Robert E. Buckley, who made many of the examinations, and Dr. Berton Lattin, who searched much of the literature. Our thanks are also due to the members of the staff of the New York State Commission on Ventilation, Mr. Geo. T. Palmer, Mr. Crittenden, Mr. Doremus, and particularly to Mr. Joseph Herzstein, for assistance in keeping the records and carrying on the engineering work in connection with the experiments.

The writer also desires to thank Dr. James Alexander Miller, the medical member of the Ventilation Commission, for much valuable aid and advice.

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137 East Fifty-fourth Street.

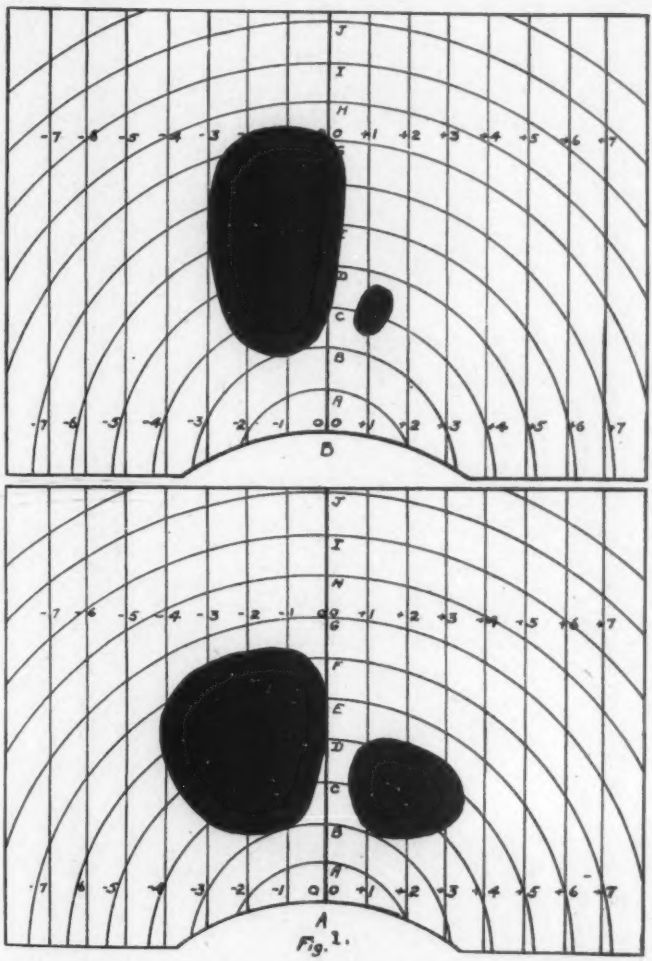


Fig. 1.

A. Plate record taken in normal room, 9:25 a. m., 68° F., 50 per cent relative humidity.

B. Plate taken in hot room, 10:40 a. m., 80° F., 50 per cent relative humidity.

Shows swelling of right inferior turbinate caused by heat.

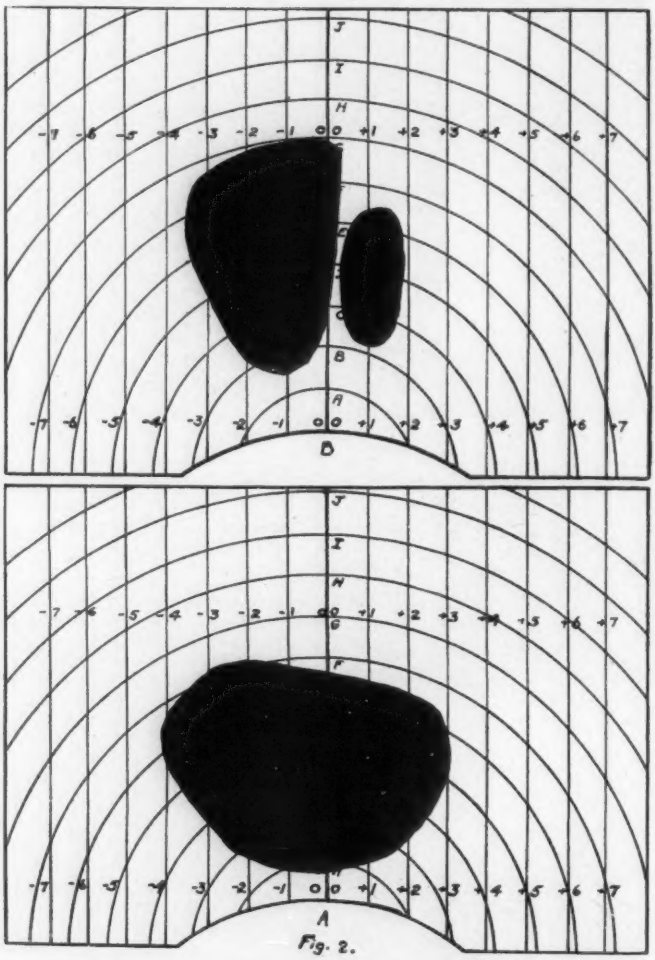


Fig. 2.

A. Normal room, 68° F., 50 per cent relative humidity.
B. Hot room, 80° F., 50 per cent relative humidity.
Shows diminished moisture deposit on right side caused by swelling of right inferior turbinate in hot room.

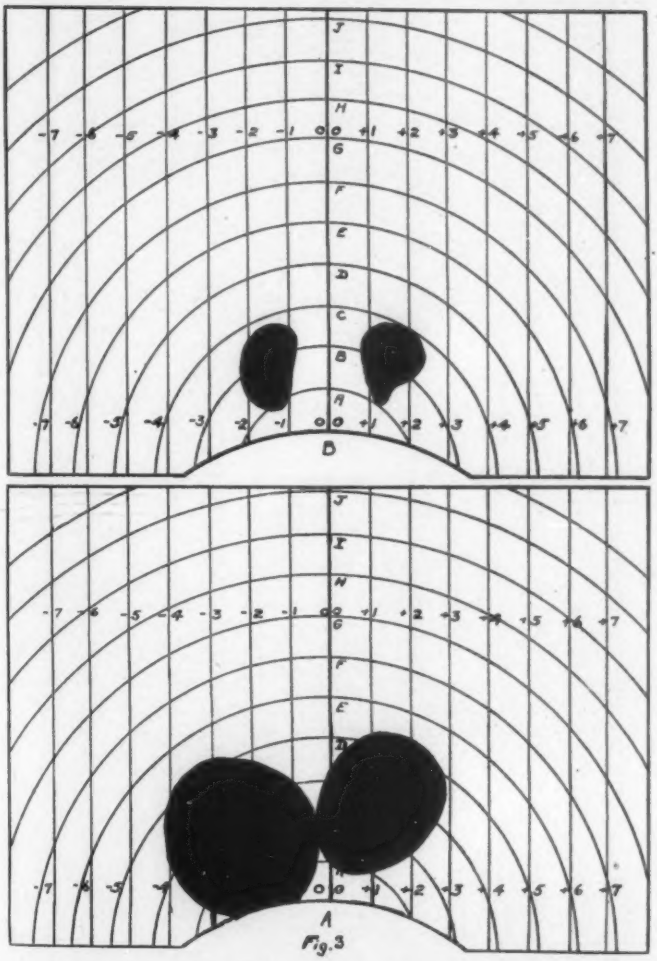


Fig. 3

A. Normal room, 68° F., 50 per cent relative humidity.
B. Hot room, 80° F., 50 per cent relative humidity.
Shows increase in size of both inferior turbinates on going from normal room to hot room.

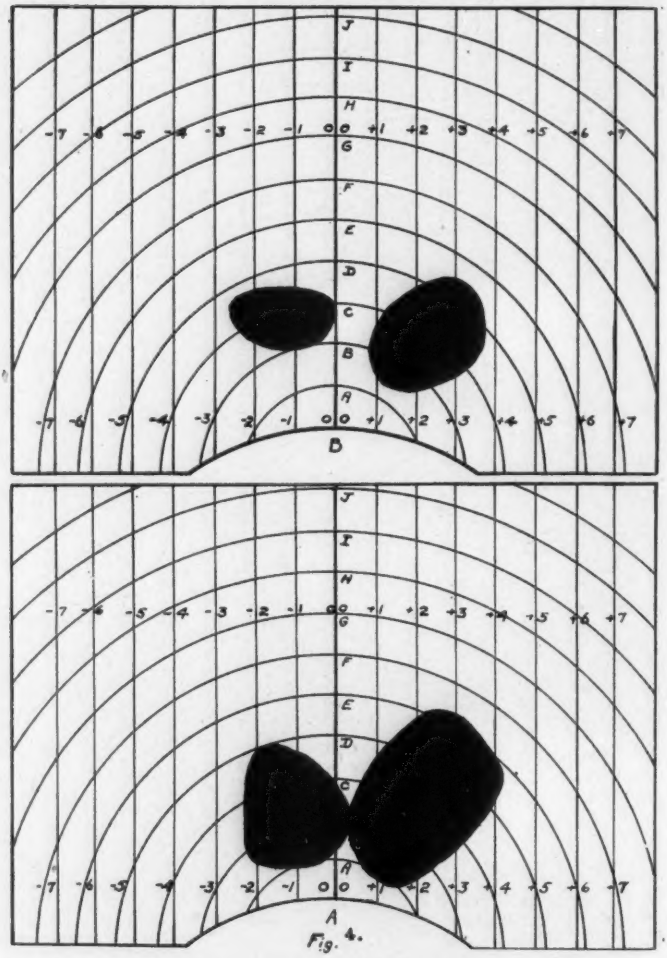


Fig. 4.

A. Normal room, 68° F., 50 per cent relative humidity.
B. Hot room, 80° F., 50 per cent relative humidity.
Shows increase in size of left turbinate on going from normal to hot room. Plate also shows slight swelling of right inferior turbinate (not noted in clinical examination).

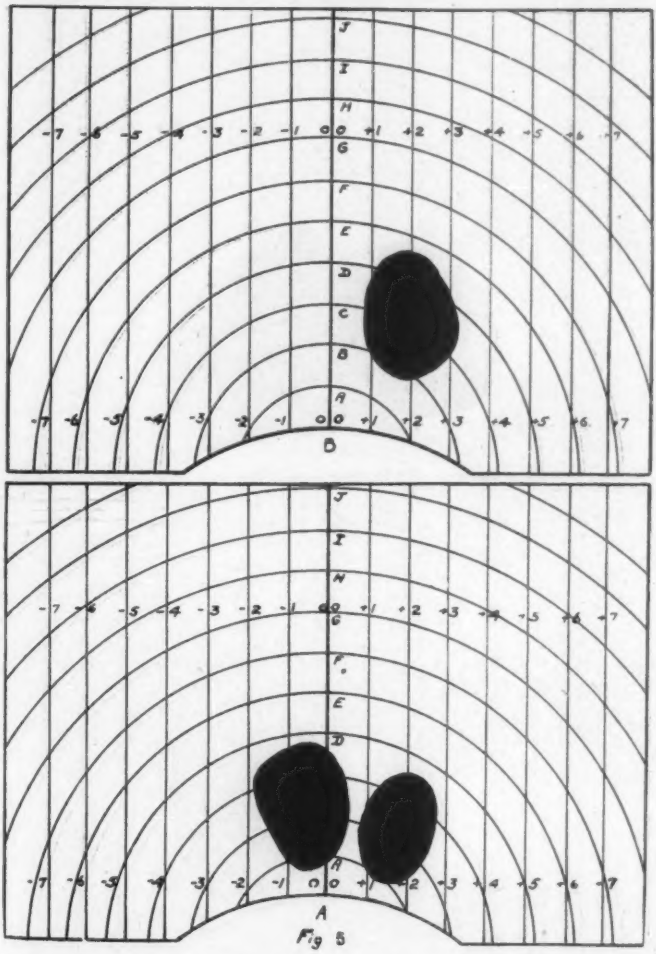


Fig 5

A. Normal room, 68° F., 50 per cent relative humidity.
B. Hot, dry room, 80° F., low humidity.
Absence of moisture deposit on left side due to total occlusion of left nostril caused by swelling of inferior turbinate in hot, dry room.

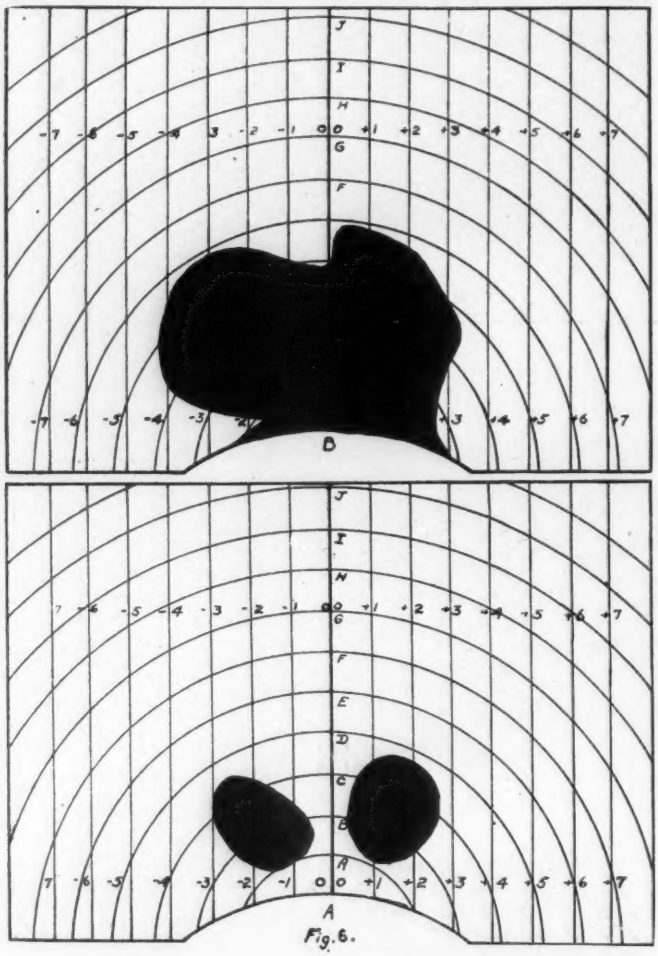
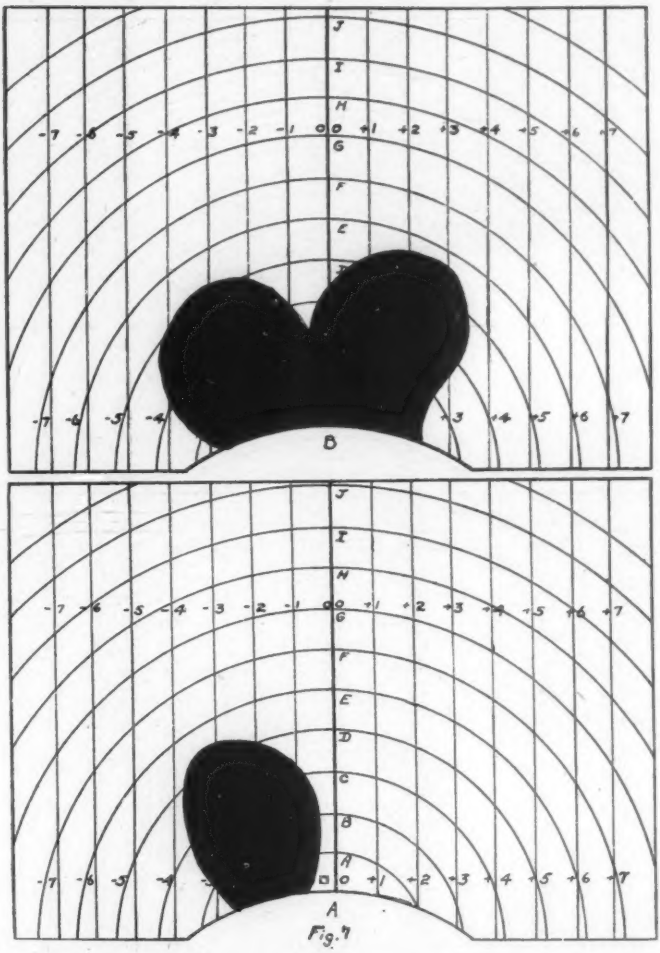


Fig. 6.

A. Record taken in hot room, 4:46 p. m., subject A3 (80° F., 50 per cent relative humidity).

B. Record taken in cold room, 5:30 p. m., subject A3 (50° F., 50 per cent relative humidity).

Shows reduction in size of both inferior turbinates when subject passed from a hot room to a cold room (medium humidities).



A. Record made in hot room, 10:20 a. m., subject B3, 80° F., 50 per cent relative humidity. Note the absence of moisture deposit on right side due to swelling of inferior turbinate.

B. Glatzel record made in cold room, 11 a. m., 50° F., 50 per cent relative humidity.

Shows marked reduction in right inferior turbinate when subject passes from hot room to cold room, medium humidities.

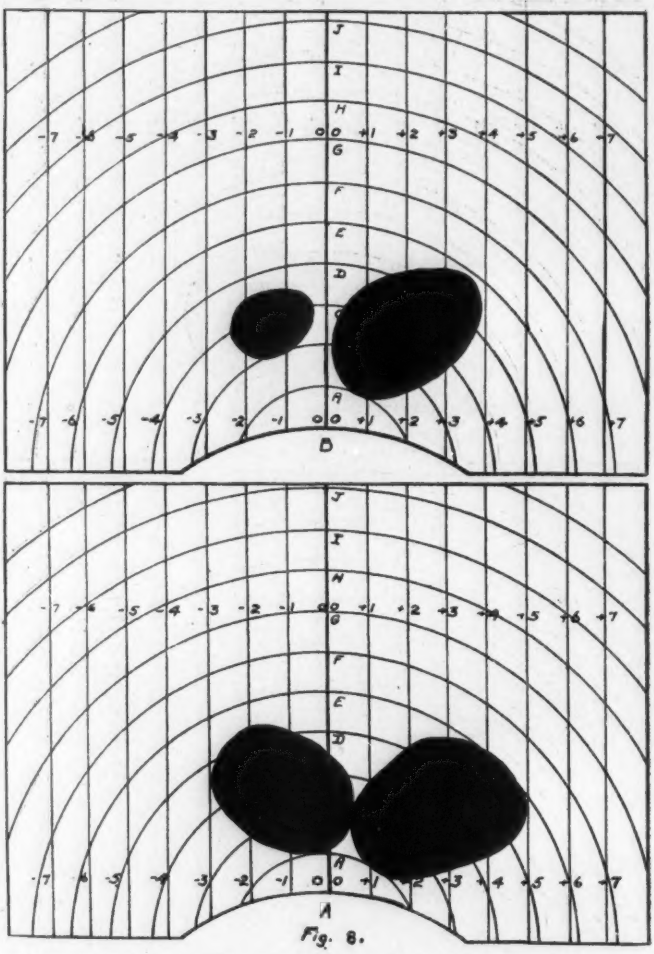


Fig. 8.

A. Plate record in cold room, 10 a. m., subject A1.
B. Plate record in hot room, 10:50 a. m., subject A1.
Shows swelling of inferior turbinate on going from a cold room (50° F., 50 per cent humidity) into a hot room (80° F., 50 per cent humidity).

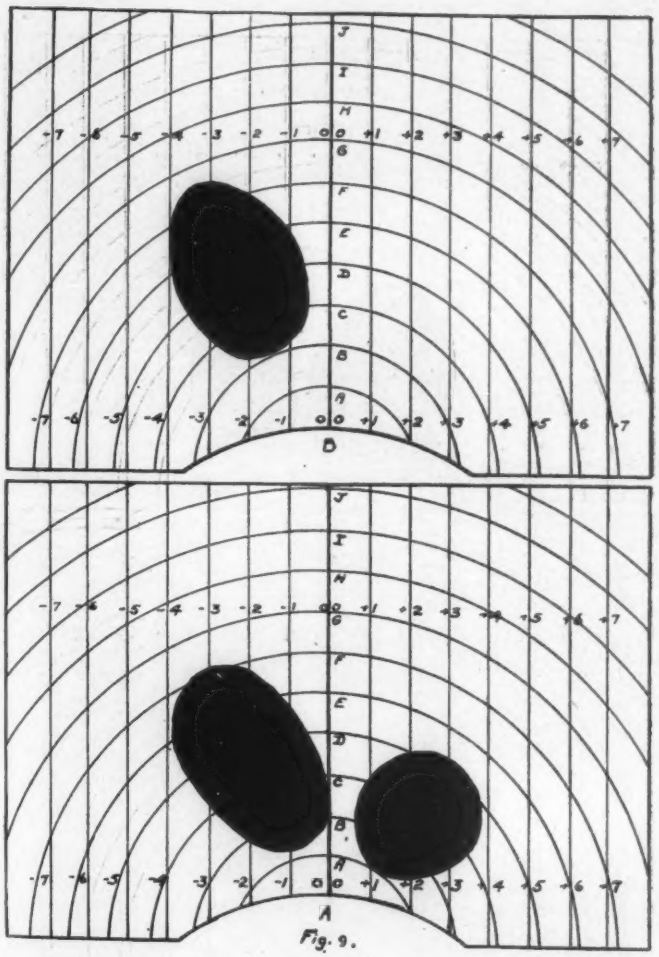


Fig. 9.

A. Record taken in cold room, 50° F., 50 per cent relative humidity, 9:20 a. m.
B. Record taken in hot room, 80° F., 50 per cent relative humidity, 10 a. m.

Shows swelling of right inferior turbinate (with obliteration of breathing space in right nostril) on going from a cold room to a hot room.

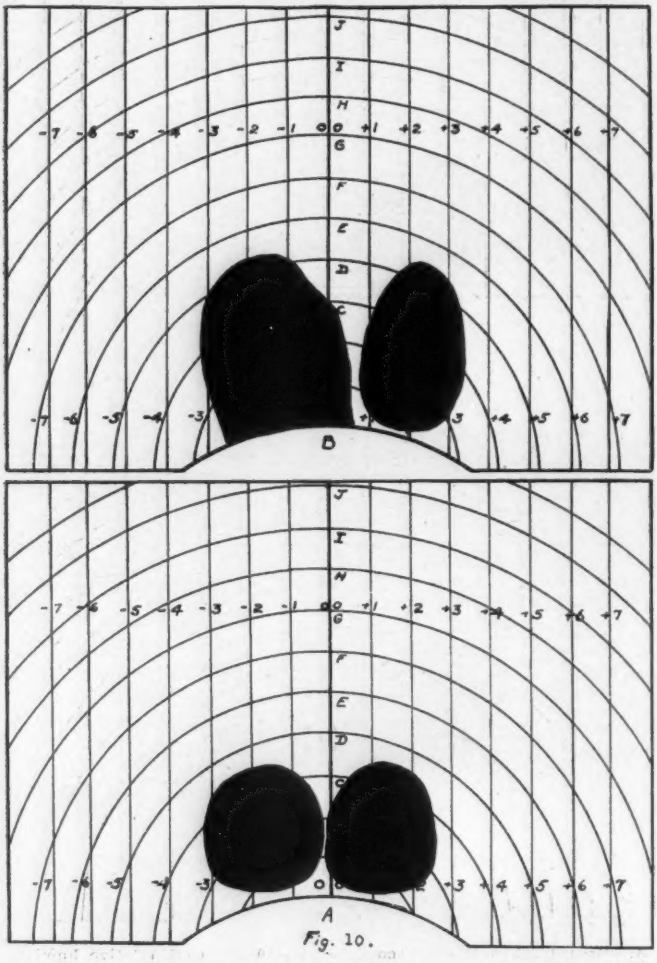


Fig. 10.

A. Record made in hot room, 86° F., 50 per cent relative humidity.
B. Record made after feet were placed in cold bath (50°).
Shows decrease in size of both inferior turbinates.

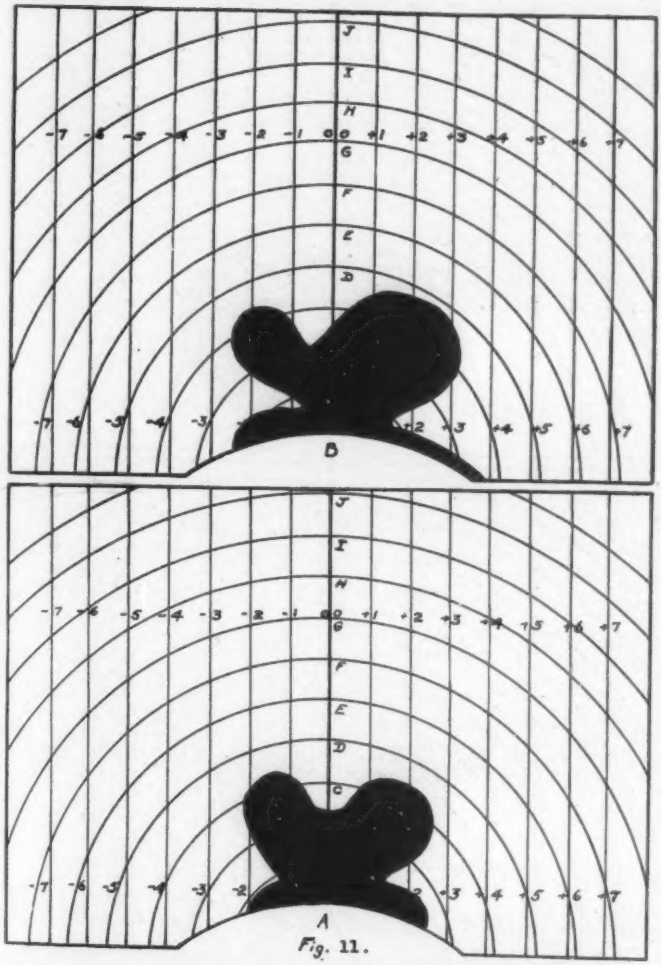


Fig. 11.

A. Record made in hot room, 86° F., 50 per cent relative humidity.
B. Record made after feet were placed in cold bath (50°).
Shows marked reduction of right inferior turbinate with a slight increase of left inferior turbinate.

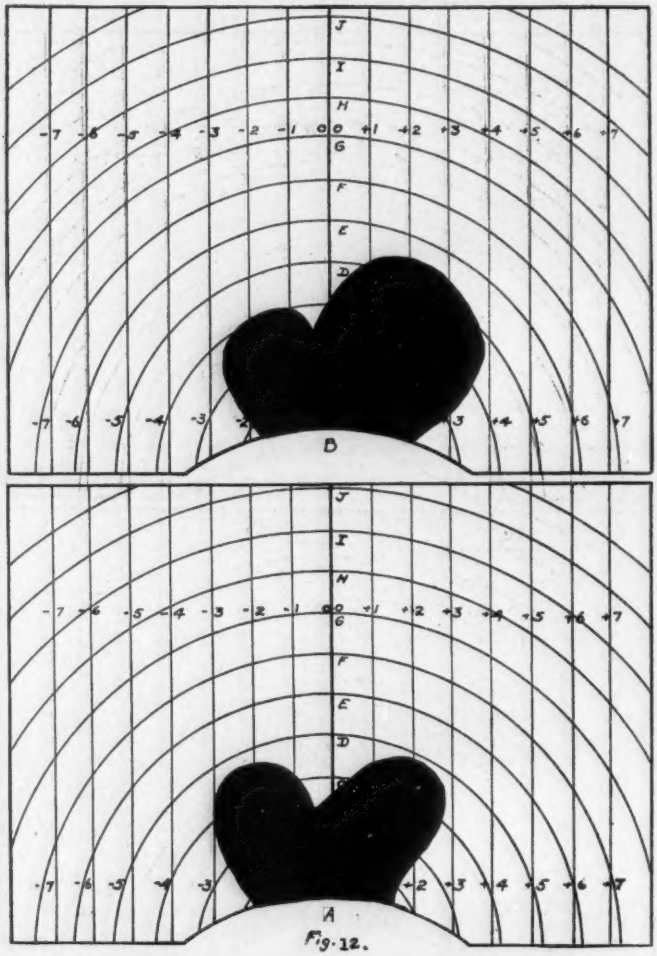


Fig. 12.

A. Record taken in normal room, 68° F., 50 per cent relative humidity.
B. Record taken in hot, dry room (fans), 86° F., 20 per cent relative humidity.

Shows decrease in size of right inferior turbinate on going from a normal room to a hot, dry room with air blown on face in hot, dry chamber by means of fans.

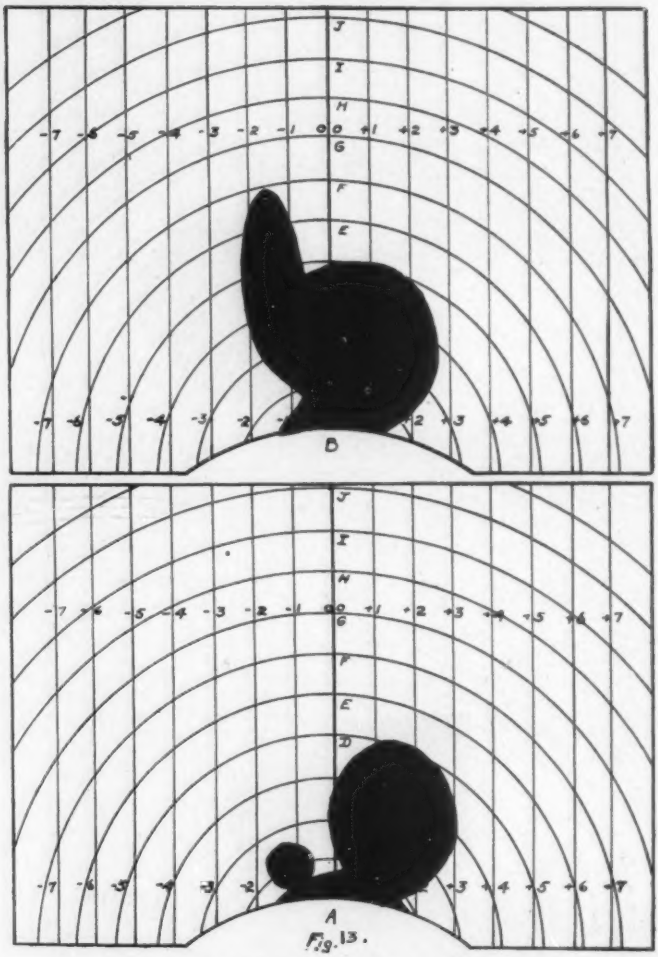


Fig. 13.

A. Record taken in hot room, 86° F., 20 per cent relative humidity.
B. Record taken in cold room (fans), 50° F., 50 per cent relative humidity.

Shows decrease in size of both inferior turbinates on going from a hot, dry room to a cold room with air blown on face in cold chamber by means of fans.

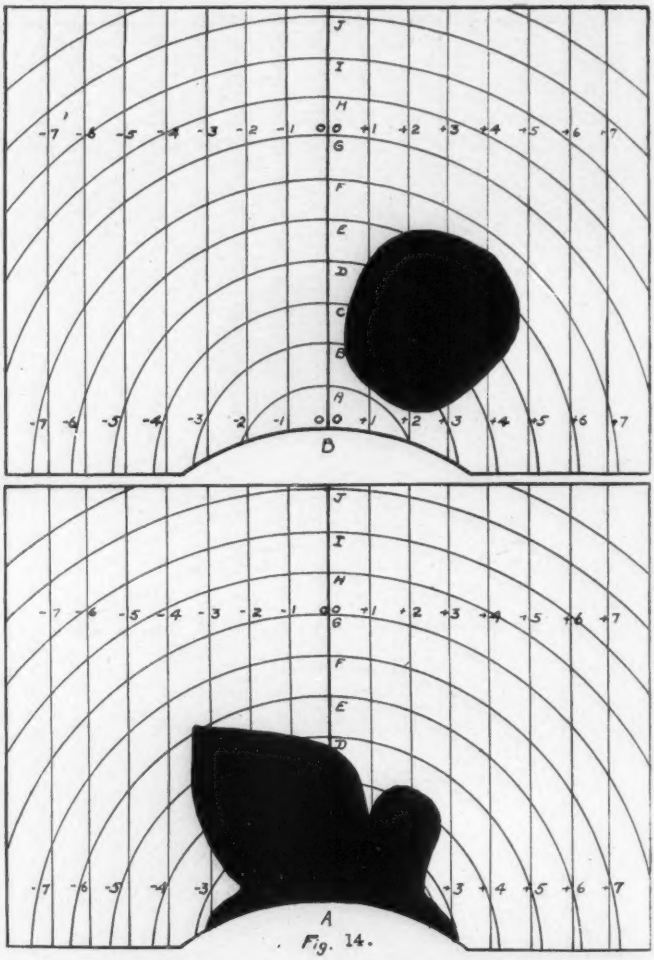


Fig. 14.

A. Record taken in hot, dry room, 86° F., 20 per cent relative humidity.
B. Record taken in cold room, 50° F., 50 per cent relative humidity.
These records were taken from a man accustomed to dry heat (stationary fireman) and show decrease of right inferior turbinate and increase of left inferior turbinate, causing occlusion of nostril, on going from a hot, dry to a cold room.

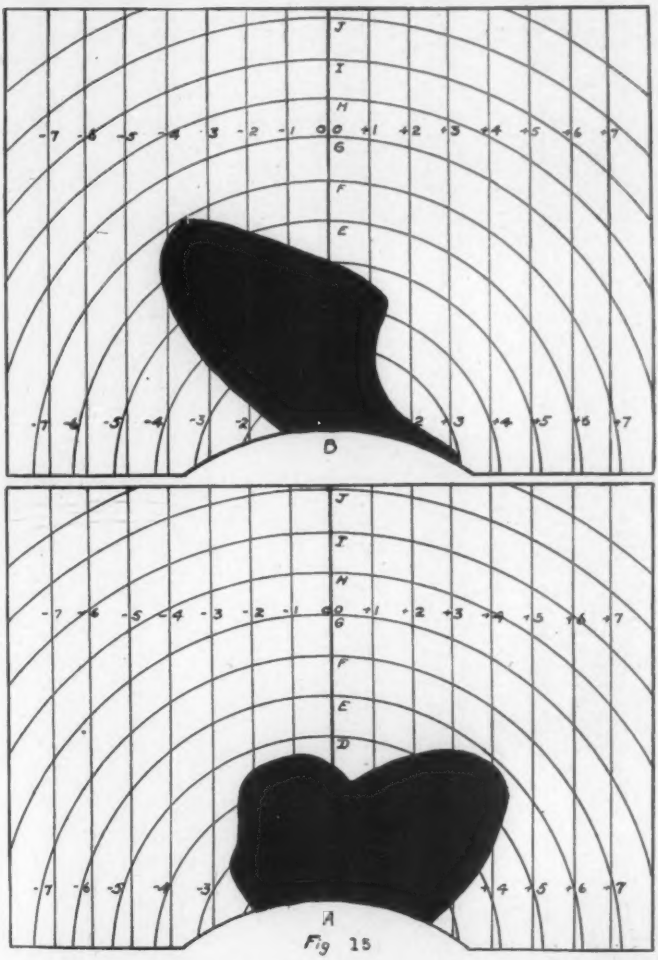


Fig 15

A. Record taken in cold room, 50° F., 5 per cent relative humidity.
B. Record taken in hot, dry room, 86° F., 20 per cent relative humidity. Record taken from a man accustomed to dry heat (stationary fireman). Shows swelling of right inferior turbinate (with occlusion of right nostril) and decrease in size of left inferior turbinate on going from a cold room to a hot, dry room.

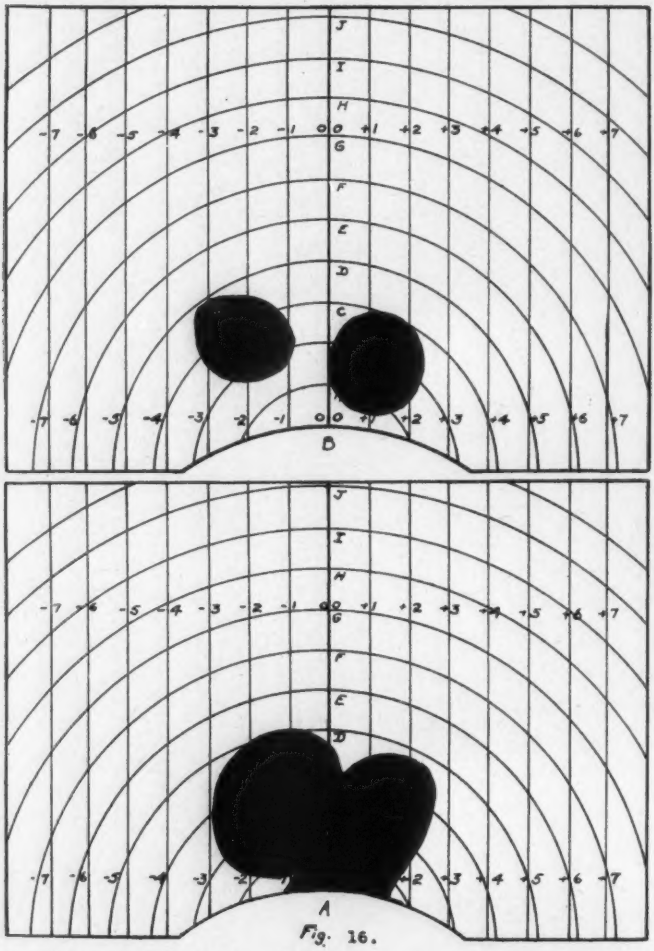


Fig. 16.

A. Record taken in hot, dry room, 86° F., 20 per cent relative humidity.
B. Record taken in a cold room, 50° F., 50 per cent relative humidity. Record taken from a man accustomed to outdoor work (postman). Shows swelling of both inferior turbinates on going from a hot, dry room to a cold room.

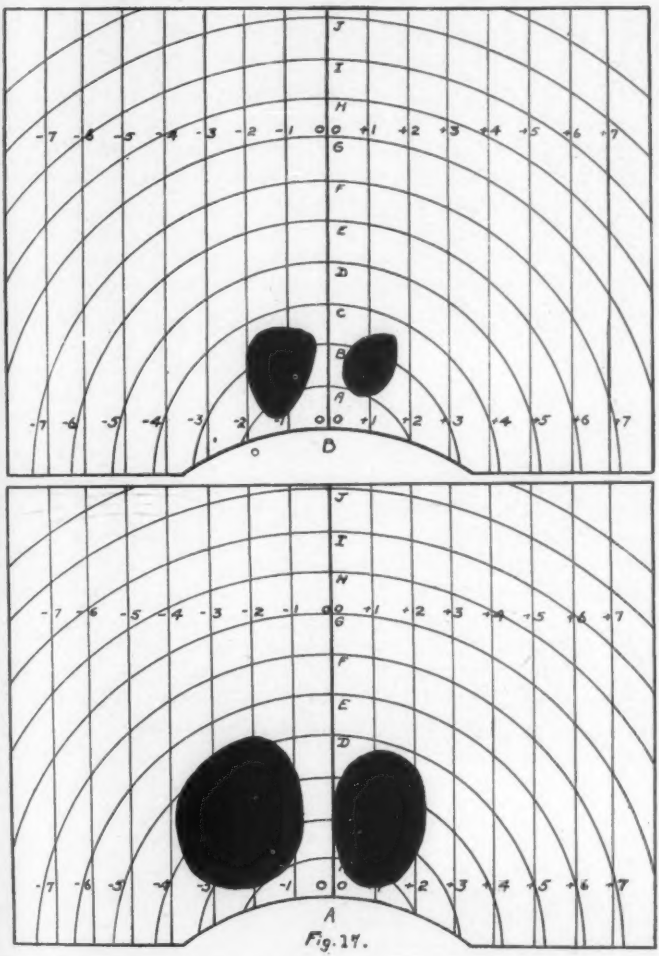


Fig. 17.

A. Record taken in hot, dry room, 86° F., 20 per cent relative humidity.
B. Record taken in cold room, 50° F., 50 per cent relative humidity.
Record taken from a man with atrophic rhinitis. Shows swelling of both inferior turbinates on going from a hot, dry room to a cold room.
NOTE.—In the clinical examination, swelling was recorded in the right nostril only.

PAPILLOMA OF THE LARYNX.*

DR. THOMAS HUBBARD, Toledo, Ohio.

REPORTS OF CASES.

Case 1. Papilloma of Larynx. Microscopical diagnosis adeno-carcinoma. H. L., age 35 years, brass worker, hoarse for six months. First seen Oct., 1897. Voice restored by removal of small papilloma. In Oct., 1903, a papillomatous growth above vocal cord, left side, was removed and examined microscopically. Diagnosis—probable epithelioma. A few months later character of growth changed—smooth and more vascular in appearance. This was removed by snare and sent to a New York laboratory for diagnosis. The report was adeno-carcinoma and thyrotomy advised. It should be mentioned that just prior to this operation his wife died following operation for supposed cancer of the breast. In March, 1904, there were many small masses above the vocal cords on both sides and one quite large in the anterior commissure. In June, 1904, the larynx was thoroughly cleaned out by snare and forceps and soon thereafter I cauterized with trichloracetic acid. This method deserves special description. I had a brass tube made—like an intubation tube with thin walls and fitted to the O'Dwyer introducer. This tube had a small opening below for breathing and a large fenestrum opposite the site of the papilloma. When the tube was in the larynx, respiration was easy and the base of the growth after removal by curette was thoroughly rubbed with crystals of trichloracetic acid. After swabbing and spraying with alkaline solution to neutralize and remove excess of acid the cannula was withdrawn. The escharotic action was confined to the fenestrated area and there was no serious reaction. The growth did not return for five years. In 1909, voice was normal but I found a small fibrous nodule at the original site. As he had no inconvenience, he refused to have it disturbed. On my advice he had given up foundry work and followed farming with decided benefit to his general health.

This man was certainly a proper candidate for thyrotomy and radical extirpation of tumor in 1903. Clinically and microscopically it had maligant characteristics.

The latest report I have is dated 1913, and there is no active recurrence.

*Read at the meeting of the American Laryngological Association, Niagara Falls, June 1st, 1915.

Case 2. Multiple Papilloma of Larynx. Asthma a complication. Mrs. B., age 40 years, hoarse for nine months, laryngeal dyspnoea for weeks. I saw her in November, 1913, and she was then in a critical condition. She had suffered from asthma of very severe type for years, aggravated in the summer and fall by hay-fever, and of late had laryngeal dyspnoea due to the papilloma. Between the three, asthma, hay-fever and laryngeal obstruction, she had a sorry time of it. Morphine and adrenalin gave some relief. Operation was very difficult as she had the usual hyperaesthesia of mucosa and no self-control. In several sittings, under local anesthesia, supplemented by large hypodermics of morphine and adrenalin, the larynx was fairly well cleared by direct and indirect method. The tumors were removed from above and below the vocal cords. Subsequent operations failed because of the asthma. She no longer responded to morphine and adrenalin and the least irritation of certain areas within the larynx would precipitate most violent attacks of bronchial spasm lasting for two hours or more. She was simply impossible—a hyperaesthetic, neurasthenic, angio-neurotic, but fortunately the papilloma did not grow; examined in 1914 and is in fairly poor health as usual with a few visible warty nodules.

Case 3. Congenital Papilloma of Larynx. R. G., age 4 years, hoarse since birth. Operated for enlarged tonsils and adenoids nine months prior to consultation. Since then aphonia and progressive dyspnoea. When I saw him in April, 1912, he was exhausted from loss of sleep and the retrocession of lower thorax was so extreme that the lower arch fairly curved upwards and backwards. Tracheotomy gave relief and I allowed him to recuperate for a few days. The edges of the tracheal incision had been stitched to the skin and under general anesthesia I curetted by direct method from above and also from below. Rather more papillomata were removed through the tracheal opening than through the laryngeal cannula. They seemed to come off more easily from below and with very little bleeding. He left the hospital in five days with good voice and there has been no recurrence to date now more than three years. The father writes that he has a clear, singing voice.

Case 4. Papilloma of Larynx in Child. M. D., age 8 years. No speaking voice for two years. Past two months increasing dyspnoea. I saw this case rather incidentally. The physician in charge had diagnosed heart dyspnoea and had given such a hopeless prognosis that the parents had decided to let her die. But she didn't pass away as predicted and counsel was called. I found a little skeleton of a girl fighting for her life, no sleep for four days and nights and on the verge of exhaustion. After the tracheotomy she slept

for thirty-six hours and it required three weeks of careful nursing to get her into operative condition. Curettment from above and below cleared the larynx temporarily. The voice returned in a few days and improved for about six months. The recurrence of papilloma was in evidence about a year later and by the same method I removed one large mass. Since then, now one year, she has a good, clear voice. Massage of the larynx and neck has been practiced since the last operation. She can sing well and probably there will be no recurrence. Since the last operation she has had successive crops of warts on the hand. The coincidence of warts and laryngeal papilloma is not rare, and, in fact, they are embryologically related. The behavior of laryngeal warts and skin warts indicate that they are both trophic in origin and further, in the eccentricities of active growth and contagiousness as well as magical disappearance they are alike. Perhaps we would do well to adhere to the Virchow nomenclature *Pacchydermia verrucosa* in certain types of *papilloma laryngis*.

Case 5. Papilloma of Larynx. L. N. C., age 35 years, aphonic for six months. Larynx quite full of small papillomata originating chiefly from anterior commissure and laterally. In the course of a year I operated twelve times—once under general anesthesia by the direct method—using forceps and curettes. His larynx was clean—no growth visible—at least six times and the voice was good, but the growths sprang up everywhere. They seemed to take root by contact. Even the under-surface of the epiglottis, where the laryngeal tube used in direct method had made pressure, developed a fungus-like mass. I tried various local applications, alcohol, fused nitrate of silver, tricholacetic acid, etc., after thorough removal, but it seemed useless. In all these operations I had carefully avoided laceration of deeper mucosa. In January, 1914, I made a thorough operation with Krause forceps and got a clear larynx. Massage of the larynx and neck had been practiced at brief intervals for a month prior to operation and continued for five months subsequently. To-day there is not a trace of growth or scar tissue. The voice is clear and a good result seems assured.

This group of cases, method of operating and results, presents only two features out of the ordinary. Curettment from below is worthy of commendation. With the head bent backward it is not difficult to pass the curette through the enlarged tracheotomy wound well up into the larynx and having the firm cricoid ring to curette against it is easier to detach a papilloma at its base than when curetting upward with only the more yielding false cords and thyroid for resistance. In doing a thorough curettment by this route one

must guard against hooking the tip of the arytenoids—otherwise the instrument can be swept freely over the whole interior, taking care to extract all fragments through the tracheal opening. I fancy that one can tell when the crop of warts is ripe by the way they yield to the curette and the absence of copious hemorrhage. It does not seem necessary to resort to the method recommended in papilloma laryngis of childhood by Clarke and others—tracheotomy and complete arrest of laryngeal function for a long period. The risks of prolonged tracheal respiration must be reckoned with. It is sometimes difficult, even impossible, to re-establish laryngeal respiration in these cases. There seems to be a reversion of the normal action of the larynx in prolonged tracheotomy respiration. It is more comfortable to the patient to breathe wholly through the cannula than to allow partial laryngeal respiration. Consequently the habit of closing the larynx during inspiration is gradually acquired. We observe this reversion of a physiologic action in many mouth-breathing children—the alae are closed during inspiration to prevent air passing through the mucous clogged nares and the habit is sometimes permanent even though the nasal passages become perfectly clear. In papilloma laryngis of childhood I would recommend early and careful curettment, repeated when necessary and present the instruments which I have found to be effective. There are curettes—chiefly of the Coakley sinus type with long handles for the upper direct method.

And a few words about massage of the larynx as an aid to prevent recurrence. This method should be thoroughly tried—manipulation of the larynx with deep massage up and down laterally and including all of the neck muscles and nerves. The strain of phonation in cases having laryngeal neoplasm produces abnormal muscle tension. The mere consciousness of this impediment to phonation tends to cause a more or less persistent muscle cramp from the submaxillary region to the anchorage below, as well as in the intrinsic muscles. This condition may be the cause of nutritional disturbance. Certainly it is a factor in producing the contact irritation which is conducive to epithelial hyperplasia. As in the last case mentioned, massage supplemented by hot fomentation followed by tonic cold applications, should be begun some weeks prior to the thorough operation and continued thereafter for a few months. The psychic effect is positively beneficial and further I am confident that my final operation in this case[5] was made more easy by the absence of the uncontrollable spasm formerly experienced. This is a refinement of detail which is worthy of trial.

Lynch, of New Orleans, has a method and a special direct technique which bids fair to quite revolutionize intra-laryngeal surgery. His modifications of the suspension apparatus, and his special instruments are the products of a genius. The surgical technique of laryngeal operations is perfecting along new lines and we reluctantly give up our old methods.

One object in presenting this paper is to bring up the discussion of the advisability of operation and re-operation in this class of recurrent neoplasms of the larynx and particularly in the young. The prevalent teaching is that we should try to give the larynx complete rest. This method is, it seems to me, unphysiological and to a degree unsurgical. Tracheotomy is necessary in most of these cases but the sooner the tube is out the better. I believe that papilloma can be eradicated either by the method described or by the Lynch method. The object of laryngeal rest is to restore normal nutrition and lessens irritation. It is probable that external massage is beneficial in precisely the same manner. Along the same line I would also suggest that voice training and easy phonation should be encouraged. In other words, give the voice organ a chance to re-establish normal functional activity by removing the offending neoplasm, early and repeated if necessary and with the least traumatism and further aid in restoring normal nutrition by external manipulations and training in voice production.

515 Nicholas Building.

Partial Laryngectomy. F. Bertrany Castillo, *Rev. de med. y Cir. pract.*, Feb. 28, 1915.

The advantages of local anesthesia in this operation, it is the author's opinion, is that there is absence of the quantity of mucous secreted during general anesthesia; there is less tendency to the severe form of secondary hemorrhage; the patient retains his consciousness and can expel blood by coughing and can approximate the vocal cords when he is ordered to do so. The operation should, of course, be preceded by preliminary tracheotomy for two reasons: (1) It prevents asphyxiation at the time of operation, and (2), it accustoms the lungs to the inhalation of cold and unfiltered air, and thus aids in the prevention of bronchopneumonia.

TEXAS SCREW-WORM INFECTION OF ENTIRE NOSE AND THROAT, INCLUDING THE ACCESSORY SINUSES.

DR. SIDNEY ISRAEL, Houston, Texas.

In dealing with the various affections one is called upon to treat in the routine of nose and throat practice, scarcely any condition, in my opinion, is more repulsive from the standpoint of the attending physician, or more serious and discomforting to the patient than an infection with the Texas screw worm (Chrysomyia Macellaria). Fortunately these infections, while not truly rare, cannot be considered common.

The screw worm is chiefly known in the tropical and sub-tropical regions of North and South America and principally identified as attacking cattle and the various lower animals. The human race, however, is very far from being immune to the attack of this unfortunate pest. The infection is produced by the adult flies, which seem to deposit their eggs at a rapid rate in a short space of time, being attracted by the presence of either an open wound or foul smelling discharge. These eggs hatch rapidly, the time having been estimated at from eight to twenty-four hours, and the young maggots begin their work of invading the tissue immediately upon having been hatched. Complete growth of the maggots takes place in five or six days, after which time they transform to the pupal stage and the flies are developed from four to fourteen days later.

In each of my cases the presence of syphilitic infection of the nose existed, with the customary offensive odor. In one case the patient positively stated that a fly had gotten into his nose and that he rapidly expelled it by forcible blowing of the nostril. In the case I am about to report, the patient was asleep and had no recollection of a fly having attacked him.

The presence of screw worm infection has been known to produce death, and it is an important point, indeed, that prompt steps be taken for the early relief of the host. The means at our command of dealing with this pest, though simple, are highly efficient and combined with promptness in attacking the disturbing element, leaves little to be desired. In my experience the use of a chloroform spray when applied directly to the site of involvement, has yielded the most satisfactory results, and the injury to the mucosa that one would suspect might occur through its use, is of such trivial importance, when dealing with a serious urgent condition of this character, that it is negligible. Care was always exercised against the injury to the mucus membrane by too much instrumentation, and the use of curettes and probes was carefully avoided. After the locality had been sprayed with chloroform the worms were removed

by means of long intra-nasal forceps only, and in that way as little trauma as possible to the mucosa was accomplished.

The medical literature pertaining to cases of this character is so meagre that it occurred to me the report of this case might be of some clinical interest.

J. A. G., age 30 years, married twice, no children. Family history negative. Past history: Patient has had diseases of childhood, namely measles, mumps, and whooping-cough. Has been troubled with his head and throat since early childhood, thought possibly due to adenoids. Up to four years ago was a heavy drinker, chiefly of whiskey. Inveterate smoker of cigarettes for many years. Seven years ago had initial lesion of syphilis, for which he received local treatment only.

About three years ago was bothered with stopping up of the nose, which seemed to be due to something hard gathered in each side. Patient would take hair pin and pull it out and every two or three days this condition would recur, with the same efforts directed towards relief. One year afterwards had it treated by specialist, who used an "electric chair and a band around the head, through which he applied electricity to the body and prescribed some medicine (unknown) internally." At times there would be a tickling in the nose and patient in his efforts to relieve this sensation would find it stopped up with soft brown lumps having foul odor. No excessive secretion of the nose, but towards the lower part, the nostrils were dry. Past two years complains of sense of smell and taste being very indistinct, and throat would become swollen and inflamed frequently. Since October, 1913, has complained of sever pains in head at intervals.

Present illness: On June 28, 1914, patient fell asleep on a cot in the yard underneath a tree, and on June 30th stated that he felt very bad, and felt as though his face was swollen and could see at a distance what seemed to be animals of various kinds. He became delirious and only occasionally would he lapse into consciousness. June 30th three worms came from his right nostril. (This latter part of the history given by his wife as the patient did not remember anything more about himself from this date).

A general practitioner was called and he gave the opinion that he would have to consult a specialist, and remarked at the time that the patient's adenoids would have to come out before the worms could be removed. Patient was brought to Houston, and entered Infirmary July 7th.

Patient's conditon upon entering hospital: Upon admission to the hospital patient was very thin and emaciated; moribund, only oc-

casionally regaining consciousness, subnormal temperature and pulse rate 132. There was every evidence of extreme general sepsis. The odor of the patient was cadaveric in character, peculiar to one suffering from grave septic infection.

He was immediately placed upon the operating table in the semi-recumbent position, and prompt steps taken to relieve him as much as possible at the original site of involvement. On account of the serious general condition of the patient a general anaesthetic was avoided, also the use of cocaine locally, as it was found that the sensation of the nasal and oropharyngeal mucosa was practically nil. Nasal examination revealed a complete obliteration of the septum, with collapse of the dorsum of the nose, due to necrosis of the nasal frame work with an opening through the skin midway on the dorsum about ⅛-inch in diameter. Practically the entire intranasal space contained numerous screw worms of various sizes. The outer nasal walls covering the antra were obliterated, and the antra were filled with screw worms. The anterior wall of the sphenoidal sinus was necrotic, and in both sinuses were found worms. The frontal sinuses were easily reached due to the extensive destruction in this locality, and in them were found several worms.

In the hard palate there was a perforation about the size of a ten cent piece, and in various places in this region including the posterior pharyngeal wall and the posterior pillars of the tonsil, and even in the tonsil itself, were found numerous worms that had succeeded in burrowing their way into the mucosa, holding on tenaciously. After a quick survey of the condition existing, an effort was made to render the site of involvement as free from the screw worm as possible; and with chloroform in an atomizer sprayed into the nostril, the large majority of the worms present were promptly removed. The greater number of them, however, had to be grasped with a forceps and even in some instances, when dealing with the involvement in the posterior pharyngeal and tonsillar region the membrane had to be incised with a knife in order to expose the worms, so successful were they in burrowing their way through the mucosa with only a small opening of entrance slightly larger than a pin head showing.

After this fairly complete removal of the worms and cleansing of the nasal cavity and oropharynx, the patient was put to bed. On account of the extreme septic condition little hope was entertained for his recovery.

The chloroform spray was ordered every two hours, also a mild potassium permanganate irrigation, in order to lessen as much as possible the offensive odor emitted by the patient.

The Murphy saline enema (drop method) was kept up continuously. For three days after his admission to the hospital there was little or no improvement; the patient was delirious at frequent intervals, and practically every time his nose was treated several worms were expelled. After this there was gradual gain in the patient's general condition. About ten days after his admission he developed a severe exophthalmus of the right eye, so severe that the idea of an enucleation was considered. When upon repeated examination, the possibility of a retrobulbar abscess suggested itself, an incision was made one-half inch below the margin of the lower lid, and with a probe a large pus pocket was found. This, through suitable drainage, gradually subsided in four or five days, with complete recession of the eye in its normal position. Four days after this condition subsided he developed a swelling in the right temporal region, with tenderness most marked about the outer margin of the supercilliary eminence. This likewise was opened and revealed a small area of necrotic frontal bone. A drain was inserted and healing gradually took place. Several days thereafter another swelling occurred, this time at about the angle of the lower jaw, on the right side. It was not opened when first noticed, as it was deemed wiser to wait until the infection had become more localized, and during the three days that elapsed before incision the movement of the jaw was markedly restricted and with the presence of some slight pain. The abscess was finally opened, drainage inserted, and improvement progressed gradually.

Cultures were made from the pus obtained from these multiple abscesses at the time of their incision and the presence of staphylococcus aureus determined. Stock vaccines of this particular strain of infection were administered, which measure aided materially the progress of recovery, and no other abscess formation occurred. The patient was improving at this time, and at the expiration of three weeks from his admission into the hospital his condition was considered safe for the administration of salvarsan which was given intravenously, 0.6 gm.

The patient was allowed to return home four weeks from the time of his admission to the hospital and mercury and iodides prescribed internally. Since his return home, which has been eleven months from this date, he has gained forty pounds, refuses another injection of salvarsan and except the deformity of his nose previously mentioned, he shows no signs of this severe and extensive infection with the Texas screw worm.

403-405 Carter Building.

THEORY OF TONSILLECTOMY: RESULTS IN PEDIATRICS.*

DR. SANFORD BLUM, San Francisco.

To obtain comprehensive data I sent to laryngologists in San Francisco the following set of questions.

1. When did you commence performing the operation of tonsillectomy?
2. Has tonsillectomy entirely replaced tonsillotomy in your practice?
3. On how many individuals have you performed this operation? (a) Under 14 years of age? (b) Over 14 years of age?
4. What do you consider indications for this operation?
5. Have results been satisfactory? How do you estimate results?
6. What morbid conditions do you attribute to diseased tonsils? (a) Local? (b) General?
7. Have any accidents occurred in your series of operations? Fatalities—number: (a) From hemorrhage? (b) Any other kind? Not fatal: (a) Hemorrhage? (b) Any other kind?
8. What do you consider contraindications to this operation?
9. When you perform tonsillectomy do you remove pharyngeal adenoids also?
10. What unfavorable sequellae to tonsillectomy have you observed? (a) Local? (b) General?

The fact that only twenty minutes is allowed for the delivery of this paper precludes my reporting even a synopsis of the forty-five responses.

In a paper entitled "The Proper Position of Tonsillectomy in Pediatrics" read before the California Pediatric Society, April 22, 1915, I discussed more fully these responses. This paper will be published in the Archives of Pediatrics.

Here I am constrained to enumerate only the portions necessary for present requirements.

Sixteen throat specialists who stated the number of tonsillectomies performed by them, estimate that since 1905 they have collectively performed 10014 tonsil enucleations. Of this number 7486 were performed on children less than fourteen years of age, 2528 after fourteen years.

*Read before the Pacific Coast Oto-Ophthalmological Society, at San Francisco, June 16, 1915.

Morbid conditions attributed to diseased tonsils are, local: frequent sore throat, recurrent tonsillitis, peritonsillar abscess, cervical adenitis, otitis media, deafness, rhinitis, chronic catarrhal conditions, respiratory obstruction, lack of development of skull; systemic, rheumatism, heart disease, anemia, nephritis, tuberculosis, arthritis, chorea, autointoxication, retarded development, gastric disturbance, diseases of metabolism, general debility, asthma, aggravating factor in individuals predisposed to hyperthyroidism.

Indications for operations named are mouth breathing, obstruction to respiration, hypertrophied tonsils, recurrent tonsillitis, adherent and diseased tonsils, sore throat, obstructed and diseased follicles, inflamed tonsils, presence of degenerated material in tonsillar crypts, diseased condition of tonsillar tissue, buried tonsils, hyperemia of fauces, enlarged cervical glands, rhinitis, repeated colds, earache, deafness, catarrh of Eustachian tubes, pressure on Eustachian tubes, acute and chronic otitis, rheumatism, arthritis, endocarditis, myocarditis, malnutrition, systemic poisoning, nutritive disturbance, obscure stomach trouble, so-called bilious attacks, retarded development, anemia, asthma, focus of infection, foul breath, anorexia, restless nights.

At a glance these lists of morbid conditions attributed to the tonsils, and of indications for their enucleation may seem to be complete. Such, however, is not the case. The literature on this subject ascribes to the tonsils many other pathologic states. Rosenheim[1] reviews as diseases associated with diseased tonsils: aneurism, appendicitis, erysipelas, meningitis, iritis, pleuritis, pericarditis, pneumonia, paraplegia, strabismus, parotitis, nephritis, osteomyelitis, phlegmon of lower extremities, oophoritis, orchitis, septic infection, erythema, erythema nodosum, purpura, erythema exudativum multiforme, typhoid, tuberculosis, rheumatism.

Lists of other morbid conditions attributed to diseased tonsils are available.[2]

From a study of such material the theory is evolved that the tonsils are the source of functional disturbances, developmental derangements, and diseases of the entire human economy—deranged skeletal development; diseases of the nervous, respiratory, digestive, urogenital, circulatory systems; disorders of the sense of taste, smell, sight, hearing; diseases of the blood and lymphatic system; local and general infections; diseases of an obscure nature such as rheumatism, chorea; disease of metabolism; diseases of the skin. And it is predicated that as the tonsils are the source of these pathologic conditions, removal of the tonsils cures or alleviates such existing conditions and that removal of these organs before their assumed

deleterious influence has been exercised would prevent the development of these conditions.

In a series of one hundred unselected, consecutive cases treated by me in the Pediatric service of the San Francisco Polyclinic tonsillectomy had been performed on twenty-two children. In eighteen cases the operation was done before the end of the eighth year; in three in the ninth and tenth years; in one at fourteen years of age. In two cases the operation was performed on account of mouth breathing; in one on account of frequent colds and tonsillar hypertrophy; in one on account of husky voice; in one on account of diseased tonsils; in two on account of cervical adenitis; in one on account of enuresis; in one on account of earache; in one case without other known cause where a child was referred to a laryngologist to be operated upon for *adhesio linguae*, and in one where adenectomy had been recommended by the attending physician. In eleven cases the reason for operating could not be ascertained. Eighteen of the cases had been tonsillectomized before they came under my care; two were operated upon by my advice; two were operated upon contrary to my advice. The cases were operated upon in various cities in the United States and I have succeeded in identifying ten different operators.

One of the children operated upon for mouth breathing developed bronchial asthma one year after the operation. The one operated upon for frequent colds and hypertrophied tonsils came to the clinic one and one-half years after the operation compaining of frequent colds and earache. The child operated upon for husky voice still has husky voice (three years after the operation). Two operated upon for cervical adenitis still have cervical adenitis. The child operated upon for enuresis, on examination, was found to have colicystitis. The child operated upon for ear trouble was relieved, as was the child whose buried tonsils were enucleated.

In seven of the twenty-two cases of tonsillectomy tonsillar tissue was present when I saw the patients—two weeks to ten years subsequent to the operation. Nine of the children have enlarged cervical glands. Two of the children have asthmatic attacks; beginning in one case one year after, in the other, two years after tonsillectomy. One case of valvular heart disease and two cases of chorea developed subsequent to tonsillectomy. In one case tonsillectomy was performed on account of earache; in four cases earache or otitis occurred subsequent to tonsillectomy. In one case there was a mastoid one year after, and in one case two years after tonsillectomy. In no case was arthritis present before or after tonsillectomy. In one case the faucial pillars were agglutinated.

Fifteen of the twenty-two tonsillectomized cases presented as their major complaint subsequent to tonsillectomy diseases associated with the upper respiratory system. During the two-year period that the one hundred cases in which these twenty-two tonsillectomies are included were under observation 33⅓ per cent (43 in 129) of all illnesses for which those under eight years were treated were assocated with the upper respiratory tract.

The short time allowed for this paper will not permit discussion of more than the most important features of the results of tonsillectomy in these cases. As it is maintained that tonsillar tissue is not reproduced when the tonsil has been extirpated and as I have reported tonsillar tissue present in approximately one-third of the operated cases it is essential to substantiate this statement. In the history of case 10, when seen two weeks after tonsillectomy, I noted in the case history "Part of the left tonsil present." One year later the laryngologist who had operated reported "small tabs left in left fossa." In THE LARYNGOSCOPE, June, 1914, No. 6, page 599, two cases are reported by Moure in which complete removal of tonsils had been performed and in which a second operation for tonsils obstructing the fauces was necessitated. Kress[2] states "It must be acknowledged that the supposed complete enucleation, or tonsillectomy, often is only a partial enucleation on tonsillotomy."

In estimating results of this operation it is only of minor importance whether the recurrent tonsillar tissue is due to inherent difficulties of the operation or to inefficiency of the operator.

In the two cases tonsillectomized on account of adenitis the glands were still enlarged when examined respectively six months and two and one-half years subsequent to tonsillectomy. Furthermore, nine of the cases had at the time of my examination enlarged cervical glands—evidence that tonsil enucleation does not prevent the development of adenopathy. Indeed, in one case (19) adenitis developed four weeks after tonsillectomy. In this case the child had carious teeth, a large diseased molar appearing to be the cause of the adenitis. This case, as well as the case of colicystitis with enuresis directs attention to the fact that, with the present popularity of tonsillectomy, obvious causes of disease are neglected.

One case of valvular heart disease and two cases of chorea developed subsequent to tonsillectomy. From which it is apparent that enucleation of the tonsil certainly does not prevent these diseases.

The increased number of ear diseases—the middle ear and mastoids—following tonsillectomy is one of the most important features of this report. It has appeared both in my private and clinical practice, that otic disease is more frequent after tonsillectomy and it is

possible that the tonsils are a protection to the auditory apparatus. Thus, in this series, two cases of mastoid occurred among twenty-two children whose tonsils had been removed; while in the remaining seventy-eight children only one mastoid occurred.

In this series of one hundred cases, 33⅓ per cent of all illnesses in children under eight years of age were associated with the upper respiratory tract, while in a control series of one hundred cases in which only four tonsillectomies had been performed 26 per cent of all illnesses were associated with disease of the upper respiratory tract—an increase rather than a diminution following tonsillectomy.

The age of eight years was selected for this comparison because three-fourths of the tonsillectomies in this series of twenty-two were performed prior to that age. The reason for this is obvious since tonsils reach their greatest development about this time and the apparent reason for removing tonsils for simple hypertrophy spontaneously disappears after this age as atrophy progresses. Similarly, three-fourths of the ten thousand cases reported by laryngologists were operated upon in childhood.

Just as it has been shown by the facts cited that the results of tonsillectomy do not justify the theory of its efficacy in curing, palliating and preventing cervical adenitis, respiratory and otic affections, heart disease and chorea, so it could be shown if time allowed that it fails to achieve other theoretical results. In the paper referred to above, read before the Pediatric Society I have discussed such fallacies.

The tonsils in infancy and childhood are essentially functionating organs. Their presence, growth and atrophy during this epoch are presumptive evidence of activity. In young guinea pigs also the tonsils are noticeable organs; in older guinea pigs they are atrophic.

Without discussing all the functions attributed to the tonsils their association with dentition merits attention. The tonsils as a rule are largest at the age of six to eight years—the period of primary dentition. It is a matter of common observation that the tonsils become considerably swollen and inflamed coincidentally with the eruption of teeth. Likewise, as in the case quoted above, tonsillar enlargement occurs when carious teeth are present. It seems that the tonsils take up deleterious matter produced during dentition. This theory is strengthened by the experiments of Henké[3] who injected charcoal into the gums of animals and man and subsequently found a large part of the charcoal in their tonsils. Lenart[4] injected charcoal into the nasal mucosa of animals and subsequently identified it in their tonsils.

Light may be thrown upon the disposition of foreign matter taken up by the tonsils by the experiments I am at present conducting. I have injected insoluble chemicals and bacteria into the cervical glands of guinea pigs and have subsequently recovered the injected matter in their tonsils and oral secretions. These experiments imply that the tonsils are excretory organs and that they receive and eliminate foreign matter from the cervical glands. Heretofore it has been accepted that the current flows from the tonsils to the cervical glands. My experiments seem to prove that a current flows from the cervical glands to the tonsils.

From all that has preceded it would seem that the practice of tonsillectomy in children should be restricted. Not every systemic infection originates in the tonsils: carious teeth, infected sinuses, adenoids, lingual tonsil,—in fact any local infection may be the source of systemic infection. It should be remembered that not the tonsils themselves but the bacteria they harbor are the noxious agents and that even when such bacteria nestle in the tonsils they do not confine themselves to this area. This consideration is important in view of the present tendency to remove tonsils as a cure for diphtheria carriers.

It is the custom to perform adenectomy also when tonsillectomy is performed and under these circumstances it is impossible when improvement is observed to know how much of the improvement is to be attributed to adenectomy. Certain it is that in many cases where adenectomy alone is performed all apparent reason for further interference vanishes.

While it seems to be an error to ascribe to a tonsillar origin the entire list of derangements at present so attributed, there are some cases—perhaps more frequent in adults—where tonsillectomy is indicated.

In Pediatric practice tonsillectomy may be indicated in recurrent peritonsillar abscess. It may cure some cases of chronic otorrhea. It should be the operation of choice in malignant disease of the tonsils. It should not be performed in infants. It should only in exceptional cases be performed before the eighth year. Between the eighth and fourteenth years if positive evidence of serious local or systemic injury emanating from the tonsil can be adduced and if the tonsillar affection does not yield to conservative treatment, enucleation is indicated.

126 Stockton Street.

THE EXAMINATION OF 106 CASES OF NASAL ACCESSORY SINUSITIS, SHOWING THE VALUE OF ROUTINE EXAMINATION AND CERTAIN INTERNASAL OPERATIVE PROCEDURES.*

DR. JOHN J. SULLIVAN, Scranton, Pa.

For several years I have been routining my cases in sinus examinations. A sinusitis cannot be diagnosed by merely looking up the nose and finding pus, or said to be absent when the pus is not found. The easier the diagnosis, the harder the cure. Time well spent in clearing up the simple, more obscure conditions will be the best means for the prevention of the more chronic lesions. It takes more than one examination to prove that the sinuses are healthy or the reverse.

Routine practiced in every case:

(1) Examine the nose before and after contraction. (Cocain and adrenalin).

(2) Syringe the nose with normal salt solution, collecting the return fluid in a black pus basin. If pus had been present, look for its reappearance.

(3) Transillumination with my frontal sinus and antrum light.

(4) X-ray and comparison with the transillumination markings of the sinus. The sinus is marked off in the dark room and the result compared with the plate. In transilluminating a sinus start low on the rheostat and gradually increase the light. This conserves the life of the lamp and at the same time gives a better idea of the part examined.

(5) Positions—Escat, head down, side examined uppermost. I have seen this to give pus also from the opposite or lower maxillary sinus where it was filled to overflowing.

(a) Head upward, erect, and erect slightly backward for the frontal sinus.

(b) Head forward on the chest for the sphenoid.

(c) Anterior ethmoids will sometimes give pus in the sphenoid position.

(d) Posterior ethmoids, head skyward in the prone position. These positions help a good deal.

(6) Puncture and irrigation of the maxillary sinus under the inferior concha. I do so in all suspected cases of sinus disease and

*Presented as a Candidate's Thesis to the American Laryngological, Rhinological and Otological Society, Chicago, Ill., June 15 and 16, 1915.

in all cases of involvement of the other sinuses. After the puncture I pass a probe through the puncture opening and examine for thickened membrane, etc.

(7) To examine the ethmoid and frontal sinuses, cocainize and adrenalinize the middle concha, the septum opposite to it, the external wall of the ethmoid as much as possible. Infract the concha with a blunt elevator or Killian long specula. Examine for thickened membrane with a probe. Note the general appearance of the cells. Trace pus if present. Probe frontal sinus gently and wash out if there is any suspicion of disease.

(8) Sphenoidal sinus and posterior ethmoids. Unless symptoms are very apparent, it is very difficult to make a diagnosis, and then only after removal of the middle concha.

Again the probe should be the factor in trying to locate the sinus (sphenoid) opening. It is impossible at times to differentiate between disease of the posterior cells and the sphenoid. Given a suspected case, it is always due to lack of drainage. The concha or deflected septum is at fault. I think it is good surgery to at least remove the obstruction. Then the sinus can be more easily examined. The Killian long speculum is a help to the examination in this region.

We should not put too much confidence in any one clinical sign. It is the group of findings that complete the picture. One word about the x-ray. I have seen the plate show a clear, healthy, dark sinus, and on operation found a sinus filled with polypoid masses. Again, the plate may show trouble in the frontal and there is little or no disease. It is well to have several plates made in doubtful cases.

The Ballenger operation for complete ethmoid exenteration has been very satisfactory to me. I have done twenty to date without any complication. I had one case of secondary hemorrhage, the only case that I packed. Coming on five days after operation. Bleeding was from the spheno-palatine artery. The above case also had a sphenoid operation at the same sitting. The bleeding was from that site.

The Mosher operation is an excellent method but not safer than the Ballenger. It is easier to do. I have had to pack every case. The Ballenger-Canfield operation on the antrum I have employed in ten cases. Results were very satisfactory. After-treatment is easy.

Some cases demand a more simple operation. The swelling of the face is sometimes complained about and objected to. I infract the inferior concha with a Luc ethmoid forceps, bringing it well

up out of place. Then I remove the antrum lateral wall with an electrical trephine, curette and forceps. (Any oval mastoid curette will answer as well as the trephine). After planing down the wall as low as the nasal floor, I rasp forward under the concha for about 4 mm.

The points to beware of are the anterior nasal duct, avoided by keeping under the attachment of the concha. The posterior palatine canal may be entered and severe hemorrhage result. It may be avoided by being careful when you cut posterior beyond one inch. That is when you begin to meet very dense bone. All fragments of mucous membrane and bone are removed and the cavity packed for forty-eight hours. The after-treatment consists in applying 40 per cent. solution of argyrol to the cavity. Washing out may be practiced when indicated. If done properly, over 90 per cent. remain open. We had about 40 cases of the above. Previous to operation all cases had been washed out from ten days to six weeks. Washing cured ten. I am choosing a few cases to illustrate the necessity of thoroughness and routine examination.

Case 1: Female, age, 45. What looked to be a typical tic neuralgia on the right side, involving the middle and inferior branch of the fifth nerve. Touching the face brought on typical attack. On examination the right maxillary sinus was found diseased. Pus and polypoid hyperplasia. Pain disappeared on operation. Duration, three years.

Case 2: Female, age, 34. Duration, four years. Complained of post-nasal dripping. Was examined repeatedly. I could find no pus in nose or epipharynx. Pus was found in both maxillary sinuses and the left sphenoid.

Case 3: Neuralgia. Male, age, 27. Duration, eight years. Pain continuous over eyes, temporal and occipital regions. Has had several pairs of glasses which afforded but slight relief. Transillumination showed both frontals large and clear, both maxillaries dark. No pus in the nose in the routine positions. Suction, negative. X-ray shows frontals large and apparently clear. Maxillaries, negative. Infraction of the middle concha. Double hyperplastic ethmoiditis present. Ethmoids exenterated. Pain relieved over the entire left side. Also over right, excepting over the frontal, where it is more intense. Washing out sinus two weeks later still gave pus. Probing found thickened membrane. (I had made a large opening into the sinus; about 6 mm. catheter could be passed). Relieved by washing. Patient lived at a distance and could see me only about once a week. In a week's time he came back again. Pain very se-

vere. Washing gave no result; could easily get a large-size tube into sinus, but solution would not come away even under great pressure. One week in hospital under observation. Typical Killian. Sinus filled with polypoid tissue, slight amount of pus. Worse after operation. Pain severe. Stiff neck, diplopia to side operated. Nothing seemed to relieve the pain. There was no photophobia, Kernig or Babinski. It seemed like the grand storm before relief. Although the x-ray had given a clear antrum I punctured and found pus. The probe found thickened mucous membrane. We were dealing with a typical neuralgia habit in a neurasthenic. So I did not see the necessity of fooling. A typical Denker found the above diagnosis correct. Diplopia disappeared two days after the Killian operation. This is over six months ago and he has had no pain on the left side since. He complains of occasional pain on the right and says if it gets worse he will have it opened. On looking over the plate since operation, especially after the operative findings on the left, I am of the belief that the right side has more or less trouble there.

Case 4: Neuralgia. Female, age, 28. Duration three years. Small frontals normal in appearance (x-ray). Maxillaries diseased (proven per radical). Washing out of frontals gave pus. Where you have a double involvement of the frontals it is a difficult matter to read the plate correctly. Pain, 80 per cent. relieved.

Case 5: Female, age, 36. Neuralgia. Frontal and temporal on the left. Duration, seven years. Examination finds small diseased frontals and maxillary sinus. Radical Denker. Found pus and polypoid degeneration of mucous membrane. Frontals treated internasally. Four months since operation, no pain in head. Occasional pain along the lateral side of the nose, accompanied by earache. Resembles a Sluder neuralgia.

Female, age, 51. Has had a sore throat for three months. Hoarseness with tonsillitis and pharyngitis. Routine findings showed empyema of both maxillary sinuses.

In conclusion, I would repeat, it is the group of clinical findings that make up the picture. Do not depend alone on one symptom. The x-ray may be at fault when all the sinuses are diseased, for it can give no comparison. It is of great value, and several plates in a doubtful case should be the rule. Develop your sense of diagnosis. Study the plates, compare them with the clinical findings and transillumination. Do not be a radical, neither be too conservative. Get the half-way stride. Pus continually in the economy is a dangerous bed-fellow. The public counts every cutting an operation no matter

how trivial. Do as much as you can in one sitting, the condition of the patient being taken into consideration. Do not operate at all where the condition is below par. Build them up a bit first. I have noticed that the badly diseased ethmoid cases complained of loss of smell. The olfactory nerves are distributed evenly to the superior concha and the corresponding part of the septum. The loss of smell in the above instance is due to nerve degeneration because it will not clear up after operation.

Again, certain cases of hyperplastic ethmoiditis lose the sense of smell after complete ethmoid exenteration. This is due to nerve destruction. Why then do not the septal divisions of the nerves play their part? It seems to me as if the greater portion of the functionating nerves were distributed more to the ethmoidal side than was formerly thought. This would demand the necessity of preserving as much as possible of the outer wall of the ethmoid (internasal side) or the so-called superior concha. The average patient is so delighted to get rid of his pain that he will not tell you of the anosmia. Question him and he will do so.

Another point, and that is the frequency with which closed maxillary sinusitis simulates frontal sinusitis, even to the site of pain and tenderness. All cleared up after washing.

After puncture it is the general rule to blow air into the sinus. No squeak means no pus, or vice versa. In a closed sinusitis (maxillary) it sometimes requires great force to even get a few drops of the irrigating material away. In these cases the blowing of air into sinus is of no value. The passing of a probe into the sinus shows only slight thickening of the lining. It is not filled up with pathologic tissue, so that cannot account for the force required. Your canula is not blocked. We then look to the normal osteum as the site of our trouble. If you cannot reach the normal opening, puncture above the inferior concha, 4 mm. above and about 20 mm. back of anterior end. I use the small size frontal sinus rasp, gradually enlarging the opening with the different sizes, biting away loose tissue with the ethmoid forceps. This gives an opening through which I can irrigate if I find it necessary.

I can only apologize for submitting the above to the Society. I have given you nothing new, so I give only the results of, at least, painstaking work of one working in the dark and seeking light.

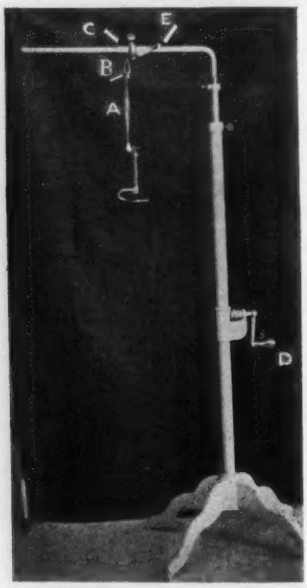
402 Wyoming St.

A NEW SUPPORT FOR THE SUSPENSION LARYNGOSCOPE.

DR. SAMUEL IGLAUER, Cincinnati.

The stand shown in the accompanying illustration has proven very satisfactory as a support for the suspension laryngoscope. Unlike the "gallows" described by Killian the stand rests upon the floor, and can therefore be adapted to the side of any table. The base is sufficiently firm and heavy to prevent the apparatus from tipping.

The hook of the suspension laryngoscope (A) is introduced into



the oval ring (B). This ring is attached to a bar which can be moved forward or backward by turning the crank (E). Side to side adjustment is obtained by means of the sleeve (C) which slides upon the horizontal bar. The entire apparatus can be raised or lowered by means of the crank (D). In addition to the above, the apparatus can be used as an irrigator stand and the like.

This apparatus is made by Max Wocher Sons Co., Cincinnati.

22 W. 7th Street.

NEW BIVALVE LARYNGEAL SPECULUM.*†

DR. HENRY LOWNDES LYNAH, New York City.

The bivalve laryngeal speculum (Fig. 1) is made with an adjustible "duck bill" tooth plate. The upper blade is made of brass in order to allow for leverage and avoid fracturing the teeth, and can be raised or lowered to accommodate the size of the mouth in which it is to be used, while the lower blade which is made of steel to avoid bending, is nothing more than a wide tongue depressor. The upper blade or tooth plate is riveted to the heavy steel lever.

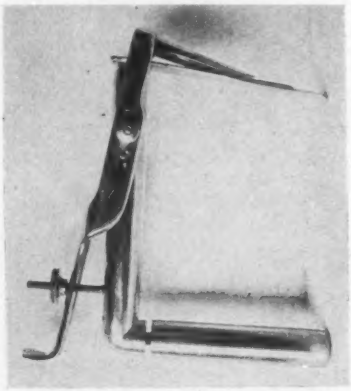


Fig. 1. Bivalve laryngeal speculum, showing blades closed for introduction, and spatula for children. The right angle handle is detached for direct intubation.

The arm of the lever is slotted and attached to the upper third of the handle of the speculum by an adjustible screw lock. In the lower portion of the lever which is reflected over the handle of the speculum there is a long slot through which passes a fixed post double threaded for the wheel which when screwed tightly down against the long arm of the lever locks it in contact with the handle of the speculum and opens and fixes the tooth plate (Fig 2a) so that the mouth cannot be closed.

*Clinical demonstration of direct intubation-extubation before the Section on Laryngology and Rhinology, New York Academy of Medicine, Jan. 27th, 1915.

†Made by Geo. Ermold, of New York City.

The spatulas are interchangeable so that the spatula for the child as well as for the adult (Fig. 2b) are readily attached to the universal handle. The spatulas have double carriers. The wiring is in

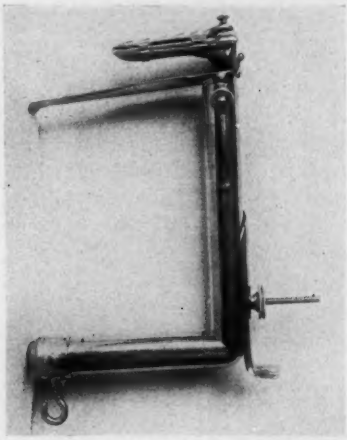
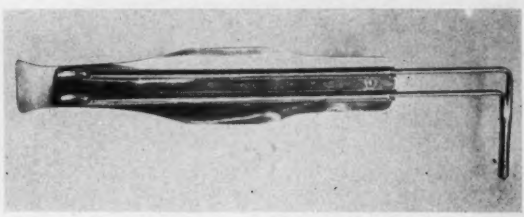


Fig. 2. (a) Tooth plate or mouth gag of speculum opened and locked. The cuff hook on the right angle handle, and the tooth block on the upper blade are detachable, and are only attached for suspension laryngoscopy.



(b) Adult tongue depressor spatula, lateral view, showing double light carrier.

multiple series and no short circuit can occur should one light go out, for the other light will continue to burn and give good illumination.

24 West Fifty-ninth Street.